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Civil Engineering.

Description of the Bear Trap Sluice Gates of the Lehigh Descending Navigation. By Ellwood Morris, *Civil Engineer.*

The public are indebted to the inventive genius of Josiah White, Esq., President of the Lehigh Coal and Navigation Company, for the admirable hydrostatic contrivance which has received the singular name of *Bear Trap.**

These sluice gates were devised under the following circumstances: in the year 1818, Messrs. White, Hauto, Hazard, and others, associated themselves under the style of the "*Lehigh Navigation Company,*" for the purpose of improving the Lehigh river by means of wing-dams, &c., so as to form a descending navigation suitable for the transportation of coal from the Anthracite mines, near Mauch Chunk, to the city of Philadelphia.

This work was commenced upon the 10th of August, 1818, as appears by the "History of the Lehigh Coal and Navigation Company, published by order of the board of managers in 1840," and did not originally contemplate the use of sluice gates as a primary expedient; the residents upon the margin of the Lehigh river having pointed out "a certain mark in a rock at the Lausanne landing," as the low-water level of the stream, Messrs. White & Co. were induced to

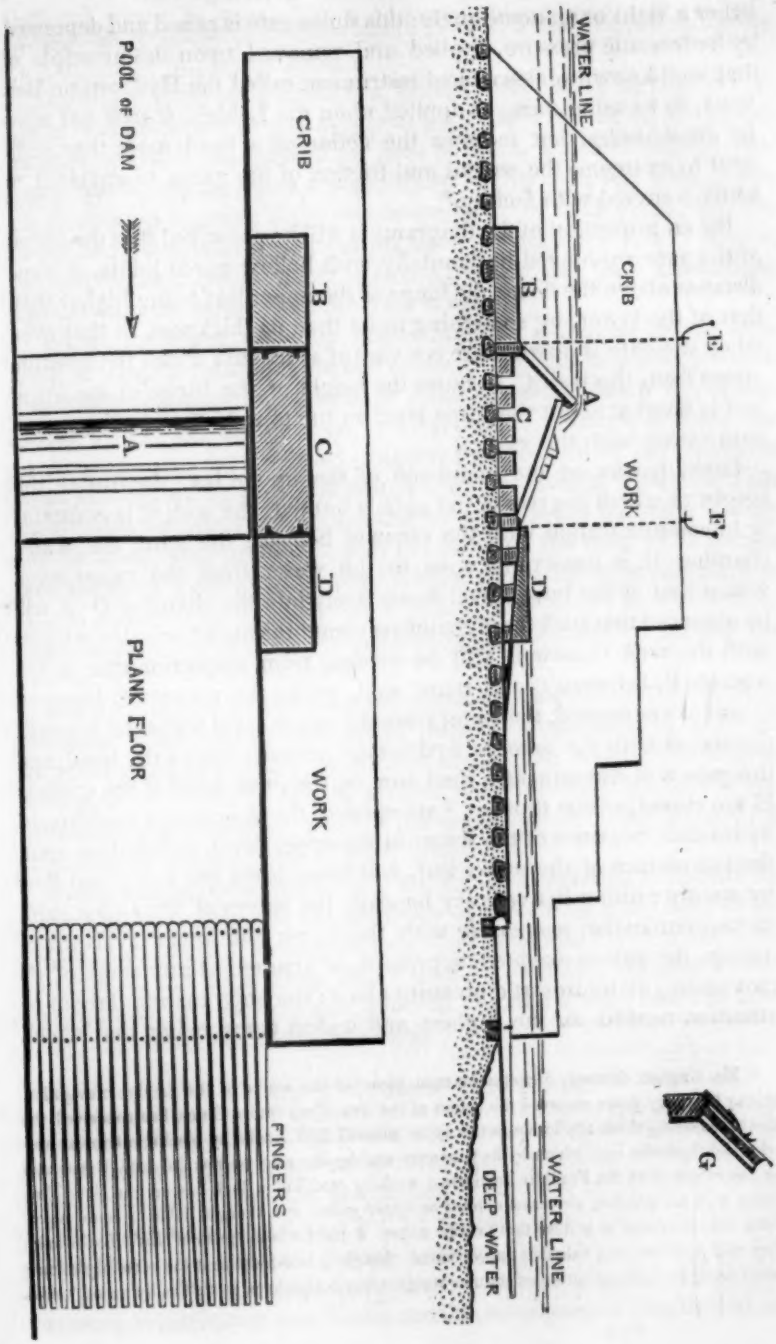
* The writer is indebted to Josiah White and Erskine Hazard, Esqs., for the opportunity of examining the drawings in the office of the Lehigh Company, and for the personal explanations which have enabled him to draw up, for the Journal of the Franklin Institute, the present account of the Bear Trap Sluice Gate.

believe that there would always be a sufficiency of water for their purposes, if it were "confined by wing-dams in its passage over the ripples, or shoals, from pool to pool," and under this impression the work was begun; but in the autumn of 1818 "the water in the river fell by an unparalleled drought, as was believed, fully twelve inches below the mark which has been mentioned as shown by the inhabitants to be the lowest point to which the river ever sunk. Here was a difficulty totally unanticipated, *and one which required a very essential alteration in the plan.* Nature did not furnish enough water by the regular flow of the river, to keep the channels at the proper depth, owing to the very great fall in the river and the consequent rapidity of its motion. It became necessary to accumulate water *by artificial means*, and to let it off at stated periods, and let the boats pass down with the long wave thus formed, which filled up the channels. This was effected by constructing dams in the neighbourhood of Mauch Chunk, in which were placed sluice gates of a peculiar construction, *invented for the purpose* by Josiah White, one of the managers, by means of which the water could be retained in the pool above, until required for use. When the dam became full, and the water had run over it long enough for the river below the dam to acquire the depth of the ordinary flow of the river, the sluice gates were let down, and the boats, which were lying in the pools above, passed down with the artificial flood."

It was to meet the exigency created by the discovery above mentioned, that Mr. White contrived the beautiful sluice gate, which we are about to describe, and upon the successful operation of which, the whole enterprise very much depended.

At that day the scene of the company's operations was almost a perfect wilderness, and the carpenters having been set at work to frame a sluice gate for trial, it became an object of great curiosity to the settlers; who being far more familiar with the implements used in the chase and capture of the beasts of the forest, than with the hydraulic works of a flash navigation, either in jest, or from some fancied resemblance of the sluice gate to a *Bear Trap*, quickly gave to it this cognomen, which it ever since has borne.

The *Bear Trap Sluice Gate*, which is exhibited in plan and section in the annexed diagrams, consists of two leaves or shutters, reclining against each other so as to present a triangular vertical section, and contain beneath them a space capable of being filled with water from the superior level and emptied thereof at will; the contained angle at the vertex when the gates are up being rather more than 100°, in order that the leaves may slide easily, one over the other, which they evidently would not do if the vertical angle of the uplifted gate were


POOL of DAM
CRIB
B
A
C
D
PLANK FLOOR
WORK
FINGERS
WATER LINE
CRIB
B
E
A
C
WORK
F
D
DEEP WATER
WATER LINE
G

either a right or an acute angle; this sluice gate is raised and depressed by hydrostatic pressure, applied and removed upon the principle of that well known philosophical instrument called the Hydrostatic Bellows; in its usual form, as applied upon the Lehigh, *it will not work in dead water*, but requires the action of a head more than sufficient to overcome the weight and friction of the gates, to enable it to be manœuvred with facility.*

By an inspection of the diagrams it will be perceived that the leaves of the gate are hinged horizontally with hollow quoin joints, at some distance above the floor; the hinge of the upper leaf being higher than that of the lower, by something more than its thickness, so that even when the gate is down there is a vacant space into which the aperture opens from the well C, because the height of the hinge of the lower leaf is fixed at about the same level as the tops of the openings communicating with the well.

Catch blocks on the underside of the upper leaf determine the height to which the rise of the gate is limited; the well C is constantly in communication with the vacancy beneath the gate; the water chamber B, is constantly open to the water from the upper level, whilst that of the lower level flows freely into the chamber D; it will be observed that both these chambers communicate by suitable wickets with the well C; now it will be evident from inspection that if the wickets F, between C and D are shut, whilst the wickets E between C and B are opened, the water from the upper level will enter beneath the leaves with the *upward* hydrostatic pressure due to the head, and the gate will consequently rise; now on the other hand if the wickets E are closed, whilst those at F are opened, the *downward and lateral* hydrostatic pressure of the water in the upper level, acting then upon the top surface of the upper leaf, will force down the gate; and thus by simply putting the vacancy beneath the leaves of the sluice gate, in communication *separately* with the upper and lower levels *alternately*, the gate is elevated, depressed, or arrested at any stage of its movement, by hydrostatic pressure alone; the only manual labour or attention needed for the highest and widest gates, being that which

* Mr. English, formerly a contractor upon some of the works of the Lehigh navigation, having for many years observed the action of the Bear Trap Sluice Gates, has conceived the idea of rendering them applicable as the upper gates of *Lift Locks*, by placing a large air vessel under the lower leaf, which by its buoyancy enables the gates to rise in dead water: and he has exhibited at the Franklin Institute a working model of a lock having the Bear Trap Gates with his attached air vessel applied as *upper gates;* and, though liable to some objections there is reason to believe that for the upper, if not for both, gates of *Lift Locks* only, they will prove to be a valuable improvement, though it is evident that the same object may be attained; by the application of counter weights, but not perhaps as well as by an air vessel.

is requisite to manœuvre the wickets E or F, a duty for which a mere boy would be physically competent.

The sluice gates used upon the Lehigh descending navigation, as there is no necessity of making them perfectly water tight, are allowed a play on each side of half an inch or more, which effectually prevents lateral friction; they are generally twenty-four feet wide, formed by spiking together three successive layers of thick plank, and the lower leaf is strengthened by bolting upon its back a few heavy beams, (as may be seen in the sketch annexed,) which rest their extremities against suitable stops when the gate is up.

Where the water, violently descending the sluice, leaves the platform, it usually excavates the bed of the stream and forms deep water, the sudden entrance into which, of boats shooting down the sluice, would prove very injurious to, or even destroy, them, if it were not for the ingenious device called *fingers;* these consist of the trunks of trees placed side by side, and bolted to heavy subsills, with their butts up-stream, the tops freely projecting over the lower sill some twenty feet or more; they receive in part the shock of the boat in its plunge into the deep water, and by their elasticity ease off its momentum so that it glides down with the swift stream uninjured; this dexterous mode of avoiding concussion, is found in practice fully to answer the end for which it was designed.

For the purpose of guarding the horizontal hinges of the leaves of the sluice gates against obstruction from the deposition of gravel, a glove of plank is ingeniously secured across the hinge by a curved spring, as shown at G, and in contact with this plank glove, the leaf revolves upon its hinges, without the possibility of being impaired in its action by the lodgment of hard substances.

From the above description and the annexed sketches, which are designed more to develope *the principle* of the sluice gate, than to display all the details of its construction, it is hoped that the plan and mode of action of the *Bear Trap Sluice* may be gathered without further explanation, and we will now proceed to make a few remarks upon the great usefulness of this invention.

Utility of the Bear Trap Sluice.

This skilfully devised hydraulic machine, continued in use upon the lower Lehigh—giving perfect satisfaction in practice—from the year 1821 until 1829, when the descending navigation upon the main part of the river, was abandoned for an improvement which admitted of transit in both directions: though a section upon the former plan, with its Bear Trap Sluices, still forms the navigation for the lumber trade between Whitehaven and Stoddartsville, a distance of twelve and one

fourth miles, in which by wing-dams, channels, and sluices, a fall of three hundred and thirty-six feet is overcome.

The causes which led to the substitution of a slackwater, for a flash navigation, and the difficulties met and surmounted by the ingenious and energetic individuals, who directed the works of the Lehigh company, are so interesting that we will make a digression to quote a few more passages from the company's published "History."*

"The boats used upon the Lehigh descending navigation consisted of square boxes, or arks, from sixteen to eighteen feet wide, and twenty to twenty-five feet long. At first two of these were joined together by hinges, to allow them to bend up and down in passing the dams and sluices, and as the men became accustomed to the work, and the channels were strengthened and improved as experience dictated, the number of sections in each boat was increased, till at last their whole length reached one hundred and eighty feet. They were steered with long oars like a raft. Machinery was devised for jointing and putting together the planks of which these boats were made, and the hands became so expert that *five men would put one of the sections together and launch it in forty-five minutes.* Boats of this description were used on the Lehigh till the end of the year 1831, when the Delaware division of the Pennsylvania Canal was partially finished. In the last year, forty thousand nine hundred and sixty-six tons were sent down, which required so many boats to be built, that, if they had all been joined in one length, they would have extended more than *thirteen miles.* These boats made but one trip, and were then broken up in the city, and the planks sold for lumber, the spikes, hinges, and other iron work being returned to Mauch Chunk by land, a distance of eighty miles.

"The great consumption of lumber for the boats very soon made it evident that the coal business could not be carried on, even on a small scale, without a communication by water with the pine forests, about sixteen miles above Mauch Chunk, on the upper section of the Lehigh. To obtain this was very difficult. The river in that distance, had a fall of about three hundred feet, over a very rough, rocky bed, with

* In the published history from which we quote, the opinion is advanced, that "the descending navigation by artificial freshets on the Lehigh, is the first on record as a permanent thing."

This, however, is a mistake, for the system of rendering shallow streams navigable by the mode called *Flashing*, which is "to create an artificial flood for a time by penning up the water in the river itself," and then opening the sluice or flood-gates, when the boats are passing, is supposed to have been invented by the Egyptians after the time of Alexander, and was found in use in the hydraulic works of the interior of China, when that empire was visited by the first English embassy.

See New Edinburgh Encyclop. Art. Nav. Inland.

shores so forbidding that in only two places above Lausanne had horses been got down to the river. To improve the navigation it became necessary to commence operations at the upper end, and to cart all the tools and provisions by a circuitous and rough road through the wilderness, and then build a boat for each load to be sent down to the place where the hands were at work, by the channels which they had previously prepared. Before these channels were effected, an attempt was made to send down planks, singly, from the pine swamps, but they became bruised and broken by the rocks before they reached Mauch Chunk. Single saw-logs were then tried, and men sent down to clear them from the rocks as they became fast. But it frequently happened that when they got near Mauch Chunk, a sudden rise would sweep them off, and they were lost.

"It became evident that the business on the Lehigh could not be extended as fast as the demand for coal increased, while it was necessary to build a new boat for each load of coal; besides the forests were now beginning to feel the waste of timber, (more than 400 acres a year being cut off,) and showed plainly enough that they would soon disappear, in consequence of the increased demand upon them.

"Under all these circumstances, it was concluded that the time had arrived for changing the navigation of the Lehigh into a slackwater navigation. The acting managers, who resided at Mauch Chunk, formed a plan for a steamboat navigation with locks one hundred and thirty feet long and thirty feet wide, which would accommodate a steamboat carrying one hundred and fifty tons of coal. These locks were of a peculiar construction, adapted to river navigation. The gates operated upon the same principle with the sluice gates in the dams for making artificial freshets, and were raised or let down by the application or removal of a hydrostatic pressure below them. The first mile below Mauch Chunk was arranged for this kind of navigation. *The locks proved to be perfectly effective and could be filled or emptied, notwithstanding their magnitude, in three minutes, or about half the time of an ordinary lock.*"

One of the writer's objects in making the above lengthy extract, was to enable the reader to trace the causes which led to the abandonment of the flash navigation on the Lehigh, and to see that it arose from no defect in the sluice gates or other works at first erected.

It must be evident to every one that *the Bear Trap Sluice Gates*, finding as they do their operating power in the hydrostatic pressure consequent upon the difference of level which they overcome, are capable of application to almost any width of opening; and that a gate of one hundred feet or more in length could be manœuvred as readily as one of twenty-four feet, the only additional labour requisite being that of opening and closing a few more wickets.

In the descending navigation of the Lehigh, a case occurred where a fall of sixteen feet in about three hundred was overcome by one of the Bear Trap Sluices, though it was found necessary here to bolt a series of beams upon the platform, transversely across the opening, so as to moderate the velocity of the descending volume of water, by increasing its friction upon the bottom of the passage.

For the gates of the locks of a steamboat, or other large navigation,* —for the gates of a dry dock by using the air vessel in raising; and in lowering them, a pump to extract the water from the space beneath —for all sluices where the sudden discharge of large bodies of water is required—for the waste-weirs and stop-gates of canals—and for other similar purposes, *the Bear Trap Sluice Gate* leaves nothing more to be desired, and is certainly far superior to any other contrivance for effecting the same purposes, which the writer has ever seen in practice or found described in the professional writings to which he has had access.

With gates of this sort of one hundred feet opening, having suitably prolonged chamber walls, and placed in low dams of four or five feet high, it would probably be easy to maintain throughout the year a steamboat navigation upon the upper waters of the Ohio, as the powerful steamers in use upon the western rivers, would find but little difficulty in stemming the current through such wide openings in dams of small height upon a low river, whilst in high floods they could pass up over the dams themselves, as they now do at such times over the falls at Louisville, Kentucky.

Philadelphia, October 15th, 1841.

Railways in Germany.—Railway between the Moldau and Danube.

CONTINUED FROM PAGE 246.

The railway from Budweis, in Bohemia, to Lintz, in Upper Austria, connecting the Moldau with the Danube, and the North sea with the Black sea, claims the merit of having been the first constructed and put into operation on the continent of Europe, for the transportation of passengers and freight. It was commenced when railways had made but little progress in England, and were known in Germany only in some of the deep mines of Saxony; and although intended only for horse power, and constructed accordingly, though in many respects behind the modern improvements of this kind, a short notice of it may perhaps be welcome to those who take an interest in the history of railways.

The project for this railway originated in the proceedings of the commissioners from the ten Elbe-states, who held a convention at

* When used for lock, or dock gates, proper stops should be placed to receive the leaves of the gate, both when up and when down, so as to avoid any loss of water in either of these positions, whilst lateral play enough is allowed to enable an easy motion in both directions.

Dresden in 1819, with the object of regulating the free navigation upon the river Elbe. Before parting they applied to the Austrian Government with the request to improve the navigation of the river Moldau to the town of Budweis, and to construct, from thence to the Danube, a canal, in order to connect the waters of the North sea with those of the Black sea. The late Chevalier de Gerstner, then professor of mathematics in Vienna, immediately put himself at the head of the undertaking, made a survey of the country, and proceeded to England, there to consult about the best plan of crossing by a railway the ridge of mountains separating the valleys of the Moldau and Danube, and which at the point of crossing is 1000 feet above the level of water in the one, and 1500 feet in the other river. Contrary to the opinion of some eminent English engineers, he adopted the plan of reaching the summit by a gradual ascent, and not to resort to inclined planes requiring stationary power. Returned from England in 1822, he proceeded to make very minute surveys, and on the 7th of September, 1824, received for his own person a privilege from his late Majesty, Francis I, for the construction and use of a railway between the Moldau and the Danube. In March, 1825, he formed a company of stockholders in Vienna, and constructed and finished the first thirty-nine miles, from Budweis to the summit, up to the end of 1828. The principles adopted in the construction of this part of the road were not to introduce any steeper gradients than forty-four feet per mile, nor any sharper curves than 622 feet radius; finally, never to lose again any ascended height. Difficulties having afterwards arisen with the Railway Company, in consequence of the excess of expenditure over the estimate, the Chevalier de Gerstner resigned his office as chief engineer, and the railway was, in the subsequent years, finished under the superintendence of his assistant, Mr. Shoenerer. The latter half of the road, however, which was put into operation on the 1st of August, 1832, has only the merit of having been executed in the cheapest possible manner; the principles of construction so judiciously adopted by the Chevalier de Gerstner were entirely abandoned; the railway here frequently loses ascended heights, has a maximum rise of 115 feet per mile, and curves of sixty feet radius, and in fact offers little advantage over a good turnpike road.

The total length of the railway, beginning in the centre of the town of Budweis, and terminating at Urfar, a suburb of Lintz on the Danube, is eighty miles; it was commenced in 1825, and finished in 1832, at an aggregate cost of £165,430 sterling, being only £2,068 per mile, with a single track, including all the necessary buildings, wagons, carriages, &c., &c. To cover these expenses, there were issued:—

3,783 shares, at £20, - - - -	£75,660
9,000 do. do. sold at £5 only, - -	45,000
And there was made a loan at five per cent. -	40,000
	£160,660

400 shares at £20, were given as a premium for this loan, and 1,817 shares at £20, were lately issued and sold at £11, to pay some

temporary debts, and for other purposes. 15,000 shares at £20, or £300,000, therefore, are now the capital stock of the company. Of the loan of £40,000, £1,200 are paid back annually, and there remain at present due only £28,000. The circumstance of the amount of capital stock and loan being £328,000, or just twice as large as the actual cost of the railway, must of course operate injuriously upon its dividends.

The railway from Budweis to Lintz has a single track of 43½ inches in width, measured between the rails; it passes through a very wild and broken country, frequently along steep side hills, on the edge of deep ravines; crossing from one valley to the other, winding its course in a thousand curves to the high summit, and then descending again in a still more circuitous route into the deep valley of the Danube. About one-half of the road is in Bohemia, the other half in Upper Austria. There are in the whole line, 965 culverts and bridges, 2,860,000 cubic yards of excavations and embankments, 376,000 cubic yards of dry walls, and 67,000 cubic yards of masonry laid in mortar. The dry walls were at first designed to support the superstructure of the railway, and erected simultaneously with the embankments to the requisite height; afterwards they were omitted, and the superstructure laid upon the surface of the earth, or gravel. It consists in cross ties of six feet in length, and six inches in diameter, flatted only on the lower side, and notched in to receive the longitudinal or bearing timbers of six by seven inches. The cross ties are laid at a distance of three feet from each other, and the longitudinal timbers are eighteen feet in length. Upon the latter, iron plate rails of nine feet in length, and two and a half by one-half inch, are fastened with square spikes of five inches in length. The timber is now delivered to the railway, ready for laying down, at one penny per foot run for the longitudinal stilts, and at five-sixths of a penny for the cross ties. The iron plate rails are got from the iron works in Bohemia, or Styria, at £13 10s. per ton; the spikes for fastening the rails at £1 7s. per cwt.

The railway is used principally for the transportation of salt and merchandise, which is carried on in summer and winter without interruption. During the better seasons passengers are also conveyed over the road, but their number is very small. Horse power is exclusively employed; a wagon weighing one ton is generally loaded with two and a quarter tons of goods, and according to the rate of ascent on different parts of the railway, one horse will draw two such loaded cars; three horses five wagons, one horse one wagon, and finally, two horses one wagon. The gross load drawn by one horse therefore varies from one and five-eighth tons to six and a half tons; the average load for the whole line being three and a quarter tons, allowing a net load of two and a quarter tons. The whole line is divided into six divisions, and there are, therefore, besides the principal stations at both ends, five intermediate ones, where the horses are changed. Three days are allowed for a freight train to pass over the whole line; it leaves the station in the morning, arrives at the next at noon, where the horses are changed, and then proceeds to the second

in the afternoon; the same horses pass from one station to the other and back the same day, and perform in this way twenty-seven miles regularly. The goods are received and forwarded by the Railway Company, who charge—

	Per ton, from Budweis to Lintz.
For grain and coal, - -	7.2s. or 1.08d. per mile.
Other articles, - - -	9.6s. or 1.44d. per mile.
	Per ton, from Lintz to Budweis.
For grain and coal, - -	14.4s. or 2.16d. per mile.
Other articles, - - -	18s. or 2.7d. per mile.

The company keep the railway and buildings in good order, furnish the wagons and all men necessary for repairing the same, loading, and unloading, &c.; the motive power is let to a contractor, who finds the horses, drivers, and grooms, and receives so much per cwt. carried over the whole distance between Budweis and Lintz. The amount is in some measure proportionate to the price of oats; it was fixed last year at 6s. per ton for the whole distance, (eighty miles) or at 0.9d per ton per mile, when the price of oats was 1s. 4d. per bushel, and 2d. more were paid per ton for every penny the bushel of oats increased in price. In August, the price of oats was 1s. 8½d., and the contractor got, therefore, 6s. 9d. per ton for eighty miles, or one penny per ton per mile. The charges for motive power were always determined for one whole month, the average market price of oats for the month past having served as a basis for the calculation. The public houses attached to the stables at the five intermediate stations were erected by the company, but are left gratuitously to the contractor of motive power for the accommodation of his men.

Passengers are carried daily over the railway, (except in winter,) in two different classes of carriages; the charge for a seat in a first class carriage is 6s., in the second class, 4s., being at the rate of only 0.9d. and 0.6d. per mile. Two carriages containing each six seats inside, and as many outside, start daily in the morning from each end of the line, drawn by two, three, or four horses, as the rate of ascent requires, the horses are changed five times. Half-way, near the summit, the carriages coming in opposite directions meet, and here an hour is allowed for dinner; the whole distance is generally performed in fourteen hours, including all stoppages, and the speed is from six to six and a half miles per hour. Horses and drivers are furnished by the same individual who contracted for the transportation of freight, and he receives one-half of the revenue from passengers, after deducting the salaries of conductor, and some other incidental expenses.

The following statement exhibits the traffic and travel, and the net income of this railway from the year 1833 to 1839 inclusive.

Year.	Quantity of salt transported.	Quantity of merch. transported.	Total quantity.	Wood.	Passengers carried.	Total net income.
	Cwt.	Cwt.	Cwt.	Fathoms (120 c. ft.)		£ s.
1833			331,609	2,733		6,805 14
1834			450,444	2,654	2,379	7,582 18
1835	320,212	194,040	514,252	1,862½	3,887	9,037 11
1836	352,671	190,431	543,102	2,124	3,948	9,151 2
1837	324,251	168,842	493,093	2,538	3,887	8,129 18
1838	345,647	234,813	580,460	2,078	5,454	9,773 15
1839	392,388	301,737	694,125	3,721	10,479	9,177 7

It appears, therefore, that there was a constant increase in the traffic; taking the average for the whole seven years, we have per year, 25,765 tons of goods, and 2,530 fathoms of burning wood; calculating the latter at one and a half tons per fathom, we find the annual transportation equal to 30,000 tons of goods, and 5,000 passengers; in the year 1839, there were transported 40,287 tons of goods, and 10,479 passengers.

The average net income per year amounted to £8,522 12s.; if the same be compared with the cost of the road, viz.: £165,430, it shows that the railway, from the commencement of its operations, has yielded a profit of over five per cent. on its cost; notwithstanding its most disadvantageous line and profile, the necessity of employing horse power instead of steam power, which would be much cheaper, the comparatively small traffic, and the low charges for freight and passage; a result which must be regarded as highly favourable, and encouraging for the undertaking of similar works in parts of the country less wild and mountainous, and more populous and productive.

Railway from Lintz to Gmunden, in Upper Austria.

When the first railway in Austria, from Budweis to Lintz, had been completed, in spite of the many embarrassments and difficulties which attended its progress, the company found it their interest to extend the same from Lintz to Gmunden, on the Traun-lake, which they were permitted to do under their original charter. This new railway was commenced in 1832, finished partly in 1835, and opened in its whole length in May, 1836; its principal object is to furnish the means of cheap transportation for the immense quantity of salt, which is manufactured in the vicinity of the Traun-lake, and exported principally to Lower Austria and Bohemia; passing through a very populous section of country, it also accommodates a very great local travel, and

is besides frequented by those who visit from the north, the celebrated watering place of Ishel, or the Alps in Salzburg and Tyrol.

The line of the Lintz and Gmunden Railway commences on the right bank of the Danube at Lintz, passes through several streets level with the pavement, to the outskirts of the city, in the direction of the river Traun, the course of which it then follows up to the foot of the lake of that name. The whole length is 42¼ miles, a small branch of one and a half miles leads from the main line, near Lintz to Zitzlau on the Danube, where the goods destined for Lower Austria are transhipped directly into the boats. In general, the country through which this railway passes is more favourable, the line therefore pretty direct, and the curves are gentle. The maximum rise is fifty-three feet per mile, with the exception of a short part near Gmunden, where a rise of 240 feet per mile has been adopted. The plan of construction is the same as that of the railway from Budweis to Lintz, a single track, with turnouts; the clear width three feet seven and a half inches. The total amount expended for the construction of the road, buildings, fixtures, &c., was £71,970; the cost per mile was therefore only £1,645. The funds were raised by private loans; certificates of stock, to the amount of £65,000, bearing five per cent. interest, and redeemable after ten years, were issued by the company; and in order to get subscriptions for the same, the first subscribers were promised to receive such profits as would remain after the payment of the interest, and all the current expenses. The holders of the scrips in this manner received, besides their interest, in 1836, £1,036; in 1837, £1,917; and in 1838, £2,072. For these profits they were for the future compensated by 1036 shares of the original stock of the Budweis and Lintz Railway, so that the whole profit of both railways is now regularly divided amongst the shareholders, after the interest on the loans has been paid. In 1846, the capital borrowed, of £65,000, may be paid back at once, or at the option of the company, in twenty annuities from thence, with the interest at five per cent. on the amounts due.

The contractor of motive power on this railway receives 2s. 6d. per ton for the whole distance, (42¼ miles,) or 0.7d. per ton per mile, when the price of oats is 1s. 6d. per bushel, and 1d. more per ton for every 1d. the price per bushel is greater than 1s. 6d. In August, 1840, when the price of oats was 1s. 11d., the contractor received, for furnishing the motive power, 2s. 11d. per ton for the whole distance, or five-sixths of a penny per ton per mile. The same contractor also receives 7⅓d. per passenger carried over the whole line, which is only at the rate of 0.17d. per passenger per mile. The company charges, per ton of goods of every description, 7s. 9½d. for the whole distance, or 2.22d. per ton per mile.

For passengers.—1st class, 2s. 6d., or 0.71d. per mile.
Do. 2nd class, 1s. 7d., or 0.46d. per mile.

Notwithstanding these low fares, the income from this railway has, since the commencement of its operations, been very considerable, as

may be seen from the following statement of the annual traffic and net income for the years 1836 to 1839, inclusive:—

Year.	Salt.	Merchandize, &c.	Total quantity.	No. of Passengers.	Net income.
	Cwt.	Cwt.	Cwt.		£ s.
1836	464,492	143,174	607,666	74,759	4,262 13
1837	569,232	144,809	714,041	77,905	5,236
1838	601,606	157,687	759,293	90,353	5,373 16
1839	652,218	156,106	808,324	103,713	6,004 13

At an average there were carried upon the road annually—

Salt, - - -	28,594 tons.
Other articles, - -	7,522 "
Total,	36,116 tons of goods, and 86,682 passengers.

The net income amounted, per year, to £5,219 5s., equal to seven and a quarter per cent. on the cost of the railway of £72,000.

Both railways are managed by the same Board of Directors; the technical department is superintended by a road commissioner, who receives a salary of £120 per year, besides £30 for traveling expenses, &c. The railway track is kept in order by workmen stationed along the line. There were fifty-two small houses built for them at a distance of one and three quarters to two and a quarter miles from each other; each is inhabited by a married man, who works with his wife, and receives 20s. per month, and some of the old timber for fuel. In each division of twelve to fourteen miles, a way-master is appointed, who superintends the workmen, and has a salary of £3 per month. About 600 wagons, and forty-five passenger carriages, are upon both railways; their repairs are conducted by a foreman, assisted by a carriage-maker, two harness-makers, and a suitable number of blacksmiths. The principal work-shops of the company are at Urfar and at Lest.

The railways here described have acquired additional importance since the opening of steam navigation upon the Danube, between Lintz and Vienna. The distance between the two cities is 144 miles. The iron steamboat Sophia, sixty horse power, drawing three feet water, performs the trip *down* to Vienna in nine and a half to ten hours, including stoppages. The running time is about nine hours, and the average speed, therefore, sixteen miles per hour; but it must be remarked that the river has a current of near five miles per hour, and that it requires from thirty to thirty-six hours for the same steamboat to run *up* the river to Lintz. The coal used in the steamboats upon the Danube is brought from Pilsen, in Bohemia, eighty-five miles upon a turnpike road to Budweis, and other eighty miles over the railway to Lintz. The transportation over the first costs 18s. per

ton; over the latter, only 7½s., which shows clearly the advantage of a railway over a turnpike road, even in a mountainous country. At Lintz, the coal is sold at £1 16s. per ton.

TO BE CONTINUED.

Practical & Theoretical Mechanics & Chemistry.

Memoir on the Preservation of Timber. By M. A. Boucherie, M. D.

[CONTINUED FROM PAGE 355.]

Of the Play of Timber, and the means of remedying it.

Wood, when worked up, however dry it may be, expands and contracts incessantly under atmospheric influences; from this result cracks, which are the mortification of constructors, and which become serious, when the wood employed was not sufficiently seasoned.

This seasoning, which requires a long time for timbers of ordinary dimensions, is still more slow in large pieces. The consequence is, that in proportion to the mass of wood annually cut, an enormous capital thus remains inactive. These inconveniences have for a long time employed the attention of those who cut timber, and have been a subject of much study to the engineers of the Marine department.

A more rapid seasoning has been sought for, and obtained, by squaring the wood the moment that it is cut in the forests; but the loss of time is still considerable, notwithstanding their recourse to careful piling, under sheds, and upon a carefully chosen soil.

The previous immersion of the timbers in fresh and salt water has also been tried without more success.

As to the seasoning obtained by means of furnaces and drying ovens, besides the onerous expense which they require, it is admitted that wood thus dried, absorbs again from the air a portion of the water which it had lost, and soon warps like other wood.

Steam also has been used. I have not been able to obtain any accurate accounts of this process, and of its results; and still less have I been able to determine *a priori* the good effects which are to be expected from it.

The question thus remaining without answer appeared to me to be untouched, and I commenced by studying at the same time the nature and the cause of the inconveniences which I wished to remedy.

It was easily and quickly observed that the successive changes in volume which the wood underwent, were solely due to its hygrometric state, which again was completely dependent upon its porosity, and the presence in its tissue of matters which absorb water with avidity.

The best remedy against such an evil is evidently to close all the pores, and thus to prevent the air from depositing any thing in the wood, or from removing from it those minute portions of water which are the only causes of the expansions and contractions which it experiences.

In reflecting upon the means of obtaining this result, I was led to remark that the cracks did not begin to show themselves in unseason-

ed wood until an advanced period of its drying, and when it was on the point of losing the last third of the water which it contained. To preserve this in it, then, appeared to me to be an infallible means of preventing this play, which has heretofore been inevitable. I immediately proceeded to test, by experiment, the value of this idea.

All the facts confirmed my expectations. Wood kept always moist, within certain limits, by means of the penetration with a deliquescent chloride, remained unalterable in its volume, no matter to what atmospheric variation it was exposed; it changed its weight indeed, and that even in a greater proportion than wood in its natural state, but these changes produced no alteration of the form. The fibres remained in their places, the bonds which united them neither expanded nor broke, and the wood did not appear to have been subjected to any important influence.

In order to judge of the degree of protection which this process offered against the play, I caused to be constructed of prepared wood tablets of large dimensions, and of very little thickness, some of which were left as they came from the hands of the workmen, while others were painted upon their two faces.

I observed a year after they were prepared, that these tablets had remained unaltered, while others prepared in a similar way from wood in its natural state were strangely warped.

The employment of chlorides, thus advantageous in preventing the play of wood, reduces also materially the time necessary to season it. We thus economize all the time which is necessary for the evaporation of the last third of water which it contains.

This property thus preserved in wood, allows us to employ it with confidence for all kinds of furniture, and for the doors and windows of rooms, without having to fear those crevices so fatal to the best pieces of workmanship.

By introducing, mixed with the earthy chlorides, one fifth part of pyrolignite of iron, we insure preservation for an indefinite period.

Of the means of diminishing the inflammability and combustibility of wood used in building.

When I first satisfied myself that it was possible to preserve a certain moisture in wood by means of the earthy chlorides, I easily conceived that by means of the same substances I might not only diminish in a great degree its inflammability, but also render very difficult the combustion of its carbon, thus kept out of contact of the air by the fusion of the earthy salts at its surface, and in the mass.

These expectations were confirmed by experiment. I have satisfactorily proved that wood prepared with these salts inflames with great difficulty, and incinerates with exceeding slowness, so that they may be considered practically as incombustible, and may be employed as such under circumstances where this property becomes of great importance in constructions.

Thus two cabins exactly alike, were constructed, the one of prepared, the other of ordinary wood: to set fire to them equal quantities of combustibles were used. The latter was reduced to ashes, whilst

the inner walls of the former were scarcely carbonized, and the combustion ceased.

Facts of this kind, and others which I purposely omit, appear to me conclusive, and authorize me to think that wood prepared by means of the earthy chlorides is in such a state of resistance to inflammability, and to the maintenance of combustion, that the occurrence of fires is almost impossible, unless they be not only commenced but sustained by materials foreign to the construction of the building.

Of the introduction into wood of colouring, odorous and resinous matters.

In order to terminate the enumeration of the various substances which may be introduced by the vital force of aspiration, I must mention colouring, odorous and resinous matters.

The last two classes of substances can only be introduced in solution in alcohol diluted with water, or in various essences. The penetration is then easy, and the wood preserves the odour which has been communicated to it, with the same permanence as do those, the odours of which are natural. Wood impregnated with resins becomes extremely inflammable, and is with difficulty penetrated by water. I shall not dwell farther upon these properties.

As to the colouring of wood, it may be produced either by mineral or by vegetable matters. In the first case, the colouring matter is not immediately introduced, but we present to its absorption two bodies, the mutual decomposition of which determines the formation of a third, which is the coloured body. I have thus frequently obtained a blue colour by causing, in succession to penetrate, a salt of iron, and the prussiate of potassa. By following the same method, and varying the substances, we may also vary the colours produced.

Vegetable matters are not as easily introduced as the preceding. Certain woods even refuse to let them penetrate, however limpid may be the solution used.

When we reflect upon this, is it not natural to inquire whether it may not arise from a difference in size of the mineral and vegetable molecules? and might we not thus make use of the sap vessels of different species of wood to measure the respective sizes of these molecules?

Annales de Chimie, June, 1840.

The following additional process of M. Boucherie is extracted from a more recent journal.—Trans.

New researches upon the preservation of timber.

The process of penetration of wood by the vital aspiration, can only be executed during the running of the sap; and besides, that the time is limited to certain months in the year, the cutting of the wood at that season of the year deranges all established practices, and leaves in many minds the unfounded conviction that wood not cut in winter must, of necessity, be very subject to decay.

These considerations induced the author to seek for an economical means of penetrating wood in winter, and he has succeeded in discovering a mode of penetration differing from that by vital aspiration,

equally economical, complete, by means of which, in the depth of winter, and in a very short space of time, wood may be penetrated either in the bark, or after being squared.

This process, which is only applicable to wood newly cut, and sawn into pieces of any length, consists in placing the wood vertically, and adapting to its upper extremity bags of water-proof stuff, which act as reservoirs, into which are poured the saline, or other solutions, which may be chosen, so as constantly to supply fresh quantities to the wood. In the greater number of cases, the liquid speedily penetrates by the upper extremity, and almost at the same instant the sap escapes below. The process is terminated, when at the lower end of the wood the liquid is collected perfectly identical with that introduced at the upper end.

Bulletin de la Societé d'encouragement, pour L'Industrie Nationelle.

Table indicative of the Protective Action exercised by various substances against the Decompositions which certain very alterable Vegetable Matters undergo, when placed under favorable conditions of Moisture and Temperature.

All these experiments were made at the same time, with the same weights of vegetable matter, upon which was always poured the same quantity of liquid holding in solution different weights of the bodies of which we wished to ascertain the protective action. Equal conditions of humidity were preserved by placing the different substances in precisely similar vessels in the same place, into which were poured, at the same points of time, equal quantities of water to replace that which evaporated.

Wheat Flour.—62 grammes: Experiment begun Feb. 25th, 1838.

Simple Water.—To establish a point of comparison, I moistened the 62 grs.* of flour with 30 grs. of water, and observed that on March 5th the whole mass was covered with mould, and disengaged a large quantity of putrid gas.

Deutochloride of Mercury, (Corrosive Sublimate.)—Three experiments were made with this substance, and in the first the 30 grs. of water contained 2 decig. of deutochloride; in the second, 4 decig.; in the third, 6 decig. After two months of observations none of these matters presented any traces of alteration.

Sulphate of Iron, (Copperas.)—Five experiments were made with this salt; the 30 grs. of water containing respectively 2, 4, and 6 decig., 1 and 2 grs.

In all cases the mould was only retarded for a few days. It was complete upon the twelfth in all the experiments.

Pyrolignite of Iron, (Areometer 8°.)—Eight experiments—with from 1 to 8 decig. in 30 grs. of water.

With	1	decig.	the	mould	appeared	upon the 10th
"	2	"	"	"	"	12th
"	3	"	"	"	"	15th
"	4	"	"	"	"	20th

* The abbreviation 'grs.' refers to the French weight, gramme, not to the English grain. Trans.

And it is to be observed that in all these experiments it only occupied, at the date indicated, a portion of the surface, and was not complete until eight days later.

With 5, 6, 7, and 8 decig. there was no mould upon April 25th.

Arsenious Acid.—Four experiments—the first with 2 decig.; second with 4 decig.; third with 1 gr.; fourth with 2 grs.

In the first case mould commenced upon the 10th of March and was complete on the 16th.

In the second, commenced March 12th, complete March 18th.

In the third, commenced March 15th, complete March 20th.

In the fourth, no alteration upon April 25th.

It must be remarked that in these last two experiments, the arsenic was chiefly in a *state of mere admixture.*

Saw-Dust of Green Wood.—Several experiments made with the saw-dust from green wood tend to the belief that 1 gr. of pyrolignite at 8° exercises a protection greater than that of 1 decig. of the deutochloride, which is contrary to the observations made upon flour, and beet pulp.

Moreover the dust of green wood is incomparably more alterable than that from dry wood, no matter with how much water we may mix the latter. This fact is remarkable.

95 grs. of the pulp of the beet, with the juice of which the substances tried were mixed in solution. The experiment commenced February 25th, 1838.

Pulp in its Natural State.—This experiment presented several points of mould upon March 3d; upon the 4th the mould occupied one-third of the surface; upon the 5th of March it was complete.

Deutochloride of Mercury, (Corrosive Sublimate.)—Six experiments with this substance; all indicated a complete protection, the least quantity used was 1 decig.

Sulphate of Iron.—In six experiments the least quantity of this salt used was 3 decig.; the greatest 1½ grs. Upon March 6th they were all completely mouldy.

Pyrolignite of Iron, (at 8° Ar.)—1 gr. of this salt was required to obtain a complete protection. Quantities less than 1 gr. had only the effect of retarding the decomposition more or less.

Pyroligneous Acid.—6 decig. of this acid completely prevented alteration. This experiment tends to show the powerful protective action of kreosote and the other essential oils which pyroligneous acid contains. It also points out the necessity of not saturating the acid with iron, which necessitates the separation of the kreosote.

Sulphuric Acid.—I employed from 1 decig. to 1½ grs. In the latter case it scarcely retarded the alteration for several days.

Sulphate of Copper.—This salt employed in the proportions of 1, 2, and 5 decig., 1 and 1½ grs., retarded the decomposition only for two days.

Sulphate of Zinc.—The results furnished by the sulphate of zinc were similar to those obtained from sulphate of copper.

Mr. Adcock's *Patent Spray Pump.*

Abridged from a Report in the Liverpool Courier of a communication made by Mr. Adcock to the Liverpool Polytechnic Society.

Mr. Adcock stated that his mind had been impressed, for some years past, with the difficulties and heavy expenses attendant on the present systems of pump-work, but that it was very far from his wish to disparage what has hitherto been done by others, or to undervalue, in however minute a degree, the great mechanical knowledge, and high scientific acquirements, which have been devoted to this subject. "On the contrary, sir," said Mr. A., "I could wish it most distinctly to be understood that, in so far as regards the present mode of raising from mines, *in a solid mass*, by pump-work, I do consider that our mining engineers, and especially those of Cornwall, have carried this branch of mechanics to quite as high a state of perfection as any other branch of the same science has been carried by other individuals, in the several other processes of productive industry. But it should be stated that, in the other branches of productive industry, as in the cotton, silk, woollen, flax, lace, hosiery, and iron manufactures, the various mechanical arrangements, their improvements and extension, *being above ground*, are placed prominently before the public eye; while those of the miner, *being beneath the surface of the ground*, are unseen and but little known beyond the immediate districts of their application. Nevertheless, we have an unerring test as to the value and efficiency of the improvements introduced into pump-work, by the knowledge we now possess of the greater depths to which mines can be worked, and the much greater quantities of water that can be raised from them than was done formerly."

At the Consolidated and United Mines, in Cornwall, for example, where the steam-engines that work the pumps make, on the average, eight strokes per minute, the quantity of water raised from the depth of the mine, equal to 180 fathoms, is not less than 3,800 gallons per minute. Hence, as the gallon is ten pounds, and the fathom six feet, the quantity of water raised per minute is not less than 38,000 pounds, or about seventeen tons weight, from a depth of 1,080 feet. If, therefore, the water so raised were allowed to flow at an average speed of one foot per second, or sixty feet per minute, it would form a rivulet five feet wide and two feet deep; and to raise that quantity of water per minute from the depth of the mine, not less than 2,000 horses of steam-engine power are employed, viz:—

3	engines, with	cylinders	90	inches diameter each.
3	ditto	ditto	85	ditto.
1	ditto	ditto	80	ditto.
2	ditto	ditto	65	ditto.
1	ditto	ditto	30	ditto.

Each steam-engine working upon the high pressure, expansive, condensing system.

Again, at the Mold Mines, in Flintshire, the quantity of water

raised is more than double the amount of that at the Consolidated and United Mines, or about 8,000 gallons, or 35¾ tons weight, per minute; but then the depth from which the water is raised is not so great, being, on the average, only fifty fathoms, or 300 feet. In other words, and to compare the effect with that of the Consolidated and United Mines, in Cornwall, the quantity of water raised *per minute* from the Mold Mines, and from a depth of 300 feet, is sufficient to make a rivulet 10¾ feet wide, and two feet deep, flowing, as in the former case, at the rate of one foot per second, or sixty feet per minute, and to raise this large quantity of water per minute there are employed eight steam-engines and four overshot water-wheels, viz:—

1 engine, with	80	inch cylinder and	22	inch pump.
ditto	66	ditto	22	ditto.
ditto	64	ditto	18	ditto.
ditto	63	ditto	18	ditto.
ditto	60	ditto	18	ditto.
ditto	46	ditto	16	ditto.
ditto	40	ditto	12⅛	ditto.
ditto	36	ditto	10	ditto.

And the overshot water-wheels are each forty feet diameter, and four feet eight inches wide, working a twenty-two inch pump, and three pumps each, eighteen inches diameter, being one pump to each water-wheel.

The enormous weight of materials in a deep pit is far greater than persons unaccustomed to such investigations could possibly imagine. In illustration of which, said Mr. A., I will now exhibit to the Society the weight of materials for the pit-work of the eighty inch cylinder engine, at the Consolidated and United Mines in Cornwall, to which I have before had occasion to allude:—

		Tons.
Weight of pumps, windbore, &c.,		161½
"	wood-work,	50
"	moving work,	26
"	pump rods,	40¾
"	main pump,	94¾
"	four balances and water lifts,	96½
"	load of water in pumps,	38½

In my prior statement, said Mr. Adcock, respecting the Consolidated and United Mines, I mentioned the depth of the mines to be 180 fathoms, or 1,080 feet. But I should state, that such is the average depth from which the various pumps lift the water, and that some of the pumps lift from greater depths than others. The pumps under consideration, *for example*, lift the water from a depth of 290 fathoms, or 1,740 feet. At this pit there were, and probably are, twelve lifts, or pumps, the one below the other, with a length of stroke equal to eight and three quarter feet, and making, on the average, six and a half strokes per minute. The water raised at each stroke, and discharged at the top of the mine, was equal to 32½ gallons, or 325

pounds weight; and to raise that quantity of water, *at each stroke*, 300 tons had, each time, to be put in motion, and its *vis inertiæ* to be overcome. Hence, said Mr. Adcock, from what I have stated as regards the great weight of materials, and the large-sized steam-engine employed, it must be perceptible to every one, that the outlay for such a set of pump-work is severely great; and that any considerable reduction of the cost, and the subsequent annual expenses, cannot be regarded otherwise by the miner, than as a great boon conferred upon him.

Mr. Adcock here developed the several successive steps of the progression of his improvements, until, eventually, the complex ideas he originally had were reduced to the present state of perfection, as illustrated by his Patent Spray Pump.

"About two years ago," said Mr. A., "I secured a patent in England, for a new and very peculiar process of raising water from mines and other deep places, by employing the force of *condensed air*, confined within a cylinder, and alternating in its pressure, by the action of the piston within that cylinder, from forty-five to ninety pounds on the square inch.

"The invention, when it had been perfected, was submitted to the attention of miners of extensive experience, and approved of by them; and an order, which I had received, was in progress of execution, and a considerable outlay had been incurred by the parties, when I found it necessary to put a stop to all further proceedings, in consequence of a far more valuable and practically efficient discovery having been made by me, and which, if I may be allowed to use the words of an engineering friend of celebrity, is '*simplicity itself.*'

"For this last invention, I have secured patents in this kingdom, and in several kingdoms abroad.

"The invention is, as you will hereafter find, of an extraordinary character,—the happy result of an elaborate chain, or course of reasoning; and some of the *Prospective Advantages* of the *Patent* may be thus stated:

1. I employ neither pumps nor pump-rods.
2. There is but *one lift*, whatever the depth of the mine.
3. As there is but *one lift*, I employ neither clacks nor valves.
4. The water-pipes, or pump-trees, are made and put down at little cost; they are made of sheet zinc, bent into shape, soldered, and soldered to one another; hence, flanches and screw-bolts are dispensed with.
5. Being made of sheet zinc, the pipes, of course, are of light weight, and therefore require but few, and very slight, horse-trees to support them.
6. Wear and tear, comparatively speaking, there is none.
7. The steam engine that I employ is double-acting, and not single-acting. It is of much less size, and of much less power, and there is not occasion to erect it, as in pump work, at the pit's mouth. On the contrary, one engine may, with facility, be made to work two or three pits, at considerable distances apart.

8. I economise largely in the consumption of fuel; and in tallow, packing, and the leathering of buckets and clacks; also in labour.

9. The ventilation of the mine is produced free of cost. And,

10. In taking up the present plant of a mine, to put down the new, generally speaking, the sale of the old materials will more than repay the cost of the patented apparatus.

"Having thus described to you, gentlemen, in a cursory manner, some of the advantages to be derived from the adoption of the patented apparatus, I will, in the next place, detail the chain of reasoning which led to the discovery.

"In my first patented apparatus, I had, in deep mines, a series of "*lifts;*" the same as in pump-work; consequently as in pump-work I was obliged to employ clacks or valves. Knowing that such clacks or valves are at all times liable to derangement, I was desirous, if possible, to improve the patented apparatus, by substituting a new kind of valve, or one that would lessen the number of those employed. For that purpose, I invented and patented a beautiful, simple, and efficient valve; which, judging from its simplicity and value, together with its non-liability to go out of repair, must become universal in its application to water-works and steam engines.

"By that invention I could make one valve perform the duty of four clacks; and the water-way, which, in the patented valve, is unobstructed, was of the same size as that of the pump-trees.

"Encouraged by the success I had thus experienced, I was emboldened to attempt a still further improvement of the patented apparatus, by endeavouring to lessen, even to a greater extent, the number of clacks employed. Eventually I proposed to myself the question—'*Is it possible, in the raising of water from mines and other deep places, to do without clacks or valves altogether?*'

"I knew this desirable effect could not be produced, if the water had to be raised from the mines in a compact or solid state, as in pump-work. For in a pit, 1,000 feet in depth, the column of water being also 1,000 feet, the pressure of water against the sides of the pipe at the bottom of the mine, would be about 440 lbs. on each square inch, and no pipe that could be conveniently applied in practice, could resist that pressure,—I therefore, in the next place, questioned within myself, whether the water could not be brought up from the mine in a divided state; and the obvious reply to it was, if the water be brought up in a divided state, it must be in a state of vapour or of rain.

"The chain of reasoning, thus far continued, led me to investigate the descending velocities of drops of rain, compared with what those velocities should be, by the laws of gravitation; and I found that by the laws of gravitation, the rain ought to descend towards the earth with a speed constantly accelerating; so that, if the cloud was high from which it fell, it ought by its velocity, and consequently its *momentum*, to inflict evils of a serious nature on all animal and vegetable life.

"Then, how is it that such effect is not produced?

"Simply, by the resistance of the air. Each drop of rain, while in the cloud, may be considered to be in a quiescent state. It begins to

descend, from a state of rest, with a motion constantly accelerating, and thus it continues, until it acquires a certain amount of speed; from which time forth the motion of its descent is uniform.

"This uniformity of motion is produced by the resistance of the air; by its not being able to flow from beneath the drop beyond certain rates of speed under certain amounts of pressure, and the ultimate amount of pressure being determined by the weight of the drop. Hence, the drop descends with an accelerating speed at first, compressing the air more and more immediately beneath it, until the resistance and compression become equal to the weight of the drop—thenceforward its motion is uniform.

"I then proceeded to investigate the greatest descending velocities of drops of rain, and I found that, under ordinary circumstances, they were from eight to twelve feet in a second; from which time, the remaining portion of the reasoning was clear and decisive; namely, if water in globules, of a certain size and weight, like drops of rain, cannot, under ordinary circumstances, and in consequence of the resistance which they meet with in the air, descend with a greater speed than twelve feet in a second, then it is certain that if these drops were in a quiescent state, and a current of air were made to move *upwards*, at a greater speed than twelve feet in a second, these drops would flow upwards instead of downwards, *and that too, whatever the height*. Hence, the invention was perfected. I had only to try the experiment in secret. It far surpassed all that I had expected from it, and I forthwith secured the patents. But other effects have resulted in practice, which I never calculated upon nor expected. I have had an apparatus made, on the patent principle, to raise, agreeably to an order which I had received, forty gallons of water in a minute, forty-two feet in height. It was erected at the works of Messrs. Milne, Travis & Milne, at Shaw, near Manchester. The fan, which gave motion to the air, was only three feet in diameter, and one foot wide, and it made about nine hundred revolutions in a minute. Instead of raising forty gallons forty-two feet in height, it raised at the rate of one hundred and thirty gallons of water in a minute, one hundred and twenty feet in height.

"This effect, so much greater than it ought to have been for the power expended, caused me, for some time, much anxiety of mind. It seems to have arisen from a law of nature which is but little known or understood by practical men. I cannot, however, enter upon details here. It is sufficient for me to state in this place, that the natural tendency of the current of air upwards, from the fan at Shaw was one hundred and sixteen feet in a second; a speed, I believe, hitherto never obtained, or conceived to be possible, in the raising of weights.

"By the present mode of raising water from mines and other deep places, by pumps and pump-rods, and other mechanical contrivances, the water is raised through a series of pipes, in a compact or solid state; in other words, if the depth through which the water must be raised, by one pump or one lift, be one hundred feet, then the pipes, extending to that depth, will be full of water, and the whole column of water in those pipes will be lifted at one and the same time.

"A column of water one hundred feet deep, presses with a force of about forty-five pounds on each square inch of its base.

"Hence, if the diameter of the pump-bucket, or plunger, be twelve inches, and its area, as a consequence, one hundred and thirteen inches, the weight of water to be lifted, *at each stroke*, will be about 5,085 pounds.

"In a deep mine, therefore, containing ten such columns or lifts of water, below one another, and acted on at the same time, by the same pump-rod, extending down the shaft or pit of the mine, the weight of water to be raised will be very great, being not less than 50,850 pounds, or about twenty-three tons.

"Hence to lift such a weight of water, and to overcome the friction of the water in the pipes, together with the *vis inertiæ* to put such columns of water in motion, and to support its own weight, the pump-rod must be made of great strength; and the steam engine, water wheel, or other prime power, by which the effect must be produced, must be of large size and great power.

"By consequence of that *vis inertiæ*, the friction and the great weight to be put in motion—and when steam engines are employed, the alternate action or reciprocation of the great lever or beam of the engine—the number of feet of *effective* strokes, made per minute, is comparatively small, being generally in deep mines, from about fifty to eighty feet. To explain this more fully, the whole mass of water in the ten columns, having to be raised at one and the same time, and therefore being equal in weight to one column of water of the same diameter and 1,000 feet in depth, may be considered as being lifted in the mass, through a distance of fifty, or from that to eighty, feet in a minute. Whereas by my '*Improvements in raising water from mines and other deep places, or from a lower level to a higher, which improvements are applicable to the raising of liquids generally, and to other purposes,*' I do not raise water or other liquids in the mass, nor do I find it necessary to exert a pressure, at one and the same time, of forty-five pounds on each square inch, when the height to which the water must be raised is one hundred feet; nor do I raise water by pumps and pump-rods; but in the manner now to be described.

"That is to say, by the aid of a steam engine, water wheel, or other prime mover, I give motion to a fan, or fanner, (such as is used very commonly by foundry men, engineers, mill-wrights, and others, to force a current of air into cupolas and other kinds of furnaces,) or to the piston of a blowing cylinder, (such as is used by iron masters and makers of iron, to force a current of air into blast furnaces, for the reduction of ores,) and, by aid of such fan or fanner, or blowing cylinder, I condense atmospheric air that it may, when liberated from its confinement, have a tendency to escape into the atmosphere with a velocity due to its pressure.

"When atmospheric air is condensed to a quarter of a pound pressure per square inch beyond the atmospheric pressure, and is liberated from its confinement, it moves, or has a tendency so to do, at the rate of one hundred and seventy-three feet in each second of time; at

half a pound pressure per square inch, the speed due to the pressure is two hundred and forty-five feet per second; at three-quarters of a pound pressure, two hundred and ninety-six feet; at one pound, three hundred and forty feet; at a pound and a quarter, three hundred and seventy-five feet; at a pound and a half, four hundred and ten feet; at a pound and three-quarters, four hundred and thirty-six feet; at two pounds, four hundred and sixty-seven feet; at three pounds, five hundred and fifty-five feet; at four pounds, six hundred and twenty-four feet; and at other pressures, with other velocities or rates of speed, as may be known by reference to, or consulting the Treatises that have been published on, the science of Pneumatics.

"Now, instead of raising water in the mass, as herein before described, by pumps and pump-rods, and such like contrivances, I avail myself of the mechanical effects that may be obtained from the velocities of the air, as due to the pressures herein before made known, or any other pressures that circumstances connected with mines, in different localities, may prove to be desirable.

"I cause the water that must be raised from the mine, or from a lower level to a higher, to be dispersed and carried up in drops, like drops of rain; but the velocity of those drops *upwards*, in consequence of the velocity of the air, is far greater than the *descending* velocities of rain.

"For drops of rain, when not receiving an impulse from winds, can only descend through the atmosphere with a speed of about eight feet in a second, when the diameter of each sphere or drop of rain is the hundredth part of an inch. When the diameter of the drop is the sixteenth part of an inch, the greatest descending velocity through the atmosphere is about seventeen feet in a second; and the velocities in a second, through the atmosphere, for drops of rain of other diameters, may be thus stated: for drops of rain an eighth of an inch diameter, twenty-four feet; for drops three-sixteenths of an inch diameter, thirty feet; and for drops a quarter of an inch diameter, thirty-four feet per second. Whereas, the velocity of the air, when allowed to escape from a pipe upwards at one pound pressure per square inch beyond the atmosphere, and without making any deductions for the friction against the sides of the pipes, is about three hundred and forty feet in a second. But it should be stated that, when the air is commingled with the water that must be carried up by it from a mine, or from a lower level to a higher, its motion, to a certain extent, is retarded. The velocity of the drops of water *upwards*, however, by this mode, or by these modes of raising water from mines and other deep places, is far greater than the velocities at which rain usually descends, as herein before has been described."

Mr. Adcock's invention has been put down, *practically*, at the Pemberton Pit, Wigan, which is under the management of Mr. Robert Daglish. The pit is one hundred yards deep, and Mr. Adcock proposes to bring up from that depth from two hundred and forty to three hundred gallons per minute; and, from a preliminary trial already made, there appears to be no doubt as to the success of the invention.

London Mech. Mag., June, 1841.

TO BE CONTINUED.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN OCTOBER, 1840.

With Remarks and Exemplifications by the Editor.

1. For a *Self-Acting Mule for Spinning;* William Mason, Taunton, Bristol county, Massachusetts, October 8.

It would require the whole of the specification and drawings of this instrument to make known the peculiarities upon which the claims are dependent, and we shall not, therefore, attempt any analysis of it. Such a machine is necessarily very complex, and in many of its parts it must be similar to others for the same purpose which have been patented in England and in the United States.

2. For an improvement in *Piano Fortes;* Jonas Chickering, Boston, Massachusetts, October 8.

This patent is obtained for an improvement in iron framed pianos, and the improvement consists in attaching or combining the bridge, over which the strings pass, to the straining pins, and the socket, through which the damper wires pass, to the iron frame, by casting them thereon, or by casting the whole together in one piece.

The claim is confined to this device and is expressed nearly in the above words.

3. For an improvement in the machine for *Hulling Rice* and other seed; William C. Grimes, York, York county, Pennsylvania, October 8.

The following are extracts from the specification.—"For hulling and scouring rice no principle of action has been found, perhaps, more applicable or efficient than the percussion of pestles or stampers acting upon a mass of it more or less confined. But the manner of applying this action as heretofore is imperfect, in as much as all reciprocating motion in a machine for this or other similar purpose must necessarily be."

"In my machine the motions of all the moving parts are rotary, whilst the action upon the rice or other seed is similar to that of a pestle upon a dense and partially confined mass of it; while at the same time, it is constantly receiving at one point and discharging at another, no time being lost for that purpose."

"This machine consists of a hollow metallic cylinder which revolves rapidly on its own axis; within this cylinder, where the hulling is effected, revolves another in the same direction, and about as much oftener as it is smaller in diameter. The axes of these cylinders are very eccentric, the great difference in their diameters allowing of this arrangement."

The small cylinder is armed with six or more rows of long teeth, and its axis is equally distant between the axis and periphery of the

large cylinder, so that its teeth will nearly touch the inner periphery of the large one. The upper end of the large cylinder is open, and is attached to its shaft at the bottom alone, so as to allow of its turning independently of the small one, the axis of which is permanent, and its shaft being attached to the frame at the top alone. The grain is fed in at the top and discharged at the bottom. As the large cylinder revolves with considerable velocity the centrifugal force will concentrate the rice around its inner surface; and as the axis of the small cylinder does not revolve with the large one, its teeth act upon all the rice thus concentrated.

The claim is to the "mode of hulling rice, seed, or grain, by means of the combined action of a rapidly revolving hollow cylinder and one or more smaller cylinders armed with pins, teeth, or projections, revolving upon a fixed axis and operating as set forth, it being eccentric with, and within, the former, where the hulling and scouring are effected; the said projections acting upon the rice while it densely lines, by centrifugal force, the inner surface of the hollow cylinder as before specified. I claim the application of centrifugal force to this purpose, applied in the manner specified."

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4. For improvements in the *Process of Manufacturing White Lead;* Horace Cory, Great Britain, October 8.

The first improvement claimed under this patent is the combination of the process of making lime with that for making carbonate of lead, or white lead, whereby the carbonic acid gas, evolved in the first process, is made to pass through a solution of lead and convert it into carbonate.

The second improvement claimed is for a mode of submitting a solution of lead, prepared in any known manner, to a current of carbonic acid gas. A chamber is so divided by partitions that the gas will pass down one space, then under the partition up a second space, then over a second partition, and so on, through any given number of spaces, and then out at the chimney. Each space, in which the gas descends, is covered with a perforated plate, and through the perforations in these plates the solution of lead drops, and in passing down it comes into contact with the carbonic acid gas and is converted into carbonate of lead. The solution thus impregnated with carbonic acid gas, passes into precipitating vats, and after the carbonate of lead has subsided, the surplus solution is pumped back, and is again passed through the impregnating chamber.

The claim is, first, to the "combining of the process of making white lead with the process of making lime, whereby the carbonic acid gas evolved in the latter process is beneficially applied in place of permitting it to pass into the atmosphere. And secondly to the mode of submitting suitable solutions of lead to the action of carbonic acid gas as above described."

5. For *Evaporating Solutions, Decoctions, &c., for the purpose of Concentrating them;* James W. W. Gordon, Baltimore, Maryland, October 8.

The patentee says, "The object of my improvement is principally to obviate the danger of injuring the preparation, which in articles of great delicacy sometimes takes place, by the application of the heat of a water or steam bath only; and this I effect by means of a machine which produces rapid evaporation at the ordinary temperature of the atmosphere."

This machine consists of a table either flat or convex, which is made to revolve either horizontally or vertically, and upon which the solution, &c., is suffered to percolate. The evaporation is accelerated by thus passing the fluid through the air with considerable velocity.

The claim is to the "employment of a revolving table, constructed and operating substantially in the manner of that herein described for the evaporating of decoctions, infusions, or solutions, and the producing of pharmaceutical extracts without artificial heat, as described."

The extracts thus formed are very favourably spoken of by those who have used them; they are not only superior in colour and general appearance to those made by heat, but in many instances retain those qualities upon which their value is dependent, in a manner much more perfect.

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6. For an improved *Flyer for Twisting Silk, &c.;* Edward L. Young, Norfolk, Virginia, October 8.

This flyer, instead of having the two guide wires run out their whole length parallel to, and at equal distances from the axis, has one short and one long guide wire—the short wire, or arm, extends as far only as the middle of the bobbin, and the longer arm extends to some distance beyond the end of the bobbin, and is there curved so as to bring the guide in a line with the axis of the bobbin—the guide wire being sufficiently long to admit of putting on and taking off the bobbin without moving the flyer. A ring is attached to the two guide wires of this flyer, near the extreme end of the short arm, to prevent the centrifugal force from throwing out the guide wires which constitute the flyer.

The claim is to this method of constructing the flyer.

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7. For an improvement in the *Method of Raising and Lowering Venitian Blinds;* John Weir, city of New York, October 8.

The improved method of raising blinds consists in attaching the upper end of the cords, that pass through the slats, to a roller at the top, which is turned by two cords that wind and unwind on a barrel at the end of the roller. There is a ratchet wheel on one end of the roller, into the teeth of which a pall catches. A cord is used to disengage the ratchet to allow the blinds to descend. By means of this arrangement the blinds may be raised and lowered, and retained

at any point desired, without attaching the cords to knobs as heretofore.

The claim is to the "mode of raising and lowering venitian blinds, and retaining them at any height without the operation of fixing the cords, by means of the combination of the blinds, the cords passing through the slats, the roller, the barrel on the end of the roller, and the cord passing around the same, and the ratchet wheel and catch, as described."

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8. For an improvement in the manner of constructing *Railway Tracks;* Benjamin H. Latrobe, Civil Engineer, Baltimore, Maryland, October 8.

For a description of the railway which is the subject of this patent, see vol. i, third series, p. 173.

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9. For a new *Manufacture of Cloths from worn out Wool or Silk Goods;* Reuben Daniels, Woodstock, Windsor county, Vermont, October 8.

(See specification.)

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10. For an improvement in *Fire Arms;* Silas Day, city of New York, October 8.

This patent is obtained for an improvement on that kind of fire arms that load at the breech, and it consists in making a curved chamber at the breech, which opens at the side of the barrel, for the reception of the load. The side aperture is closed by a valve which works on a pin and is provided with a handle and catch, the valve works in a slot made in a block of iron that projects from the side of the barrel, and in which block a part of the curved chamber is made.

"I am aware," says the patentee, "that guns have been made to load at the breech by having a sliding valve to close the aperture through which the charge is inserted, but not constructed like the plan herein described, and therefore I do not claim the principle of loading at the breech as my invention, but what I do claim as my invention, and desire to secure by letters patent, is the curved chamber, and in combination therewith the sliding valve and its appendages, consisting of the slot and lever, for the purpose, and in the manner herein described."

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11. For an improvement in the machine for *Cutting the Teeth of Metal Combs;* Joseph C. Ives, Bristol, Hartford county, Connecticut, October 8.

The object of this improvement is to prevent the tooth, which is being cut, from curling from the operation of the saw; an effect well known to all workers in metal. A stud is to be added to the sawing machine, which stud works on a joint pin, and is borne up by a spring; it is distant from the saw the thickness of a tooth, so that the tooth which is being cut, is held against the face of the saw, and is thus

prevented from curving. As the saw cuts into the comb plate the stud yields and allows the plate to move towards the saw.

The claim is to "pressing the tooth while cutting against the side of the saw in the manner and for the purpose specified."

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12. For improvements in the manner of constructing *Locomotive and other Carriages;* Alfred C. Jones, city of Philadelphia, October 10.

In the specification on this patent various improvements are proposed; the first of these improvements has for its object the more perfect attainment of an equal bearing of the driving wheels on the road, using therefor, the ordinary sized springs of locomotives, or other carriages, but these being so arranged and combined as to produce the intended effect, on being applied to carriages of four or of six wheels.

For a four wheeled carriage the patentee employs two bell cranks, or bent levers, on each side of the carriage. The bearings of the two are near together, and one arm of each runs out horizontally, the other vertically, either up or down. The ends of the horizontal arms bear upon the sliding boxes, in which the gudgeons of the axles work; and between the two vertical arms is placed the elliptical spring. When the principle is applied to a six wheeled carriage, four such levers are employed, the ends of the two inner levers resting upon the sliding box of the axle of the middle wheels.

The claim to this improvement is as follows, viz: "What I claim as my invention in this part of my improvements in railroad carriages of various descriptions, is the application of the bell crank or bent lever between the axle boxes and double or single elliptic springs, standing vertically and combined and arranged as above set forth."

The object of the second improvement is to throw a larger part of the weight of the carriage on the wheel which is passing over an elevation of the road, when it has become uneven, and thereby to tend to relevel it. To effect this, the ends of a bar, on each side of the car, rest on the sliding boxes of the front and rear axles, and the connexion, between this bar and the spring, is by means of two straps, or lugs, so that when one wheel is lifted up, the connexion between the bar and the spring is transferred to the strap, lug, or other means of connexion, nearest this wheel, and thus the larger part of the weight has to be sustained by it.

The claim to this second improvement is to the "manner of applying the principle of transferring a portion of the weight of the carriage or load from one wheel to another, so as to increase the pressure upon the wheel which may be upon an unduly elevated part of the rail, and decrease it on that which may be in a hollow or depression."

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13. For a machine for *Reducing worn out Cloths of various kinds to the state of Wool to be spun into yarn for the Manufacture of Cloths;* Reuben Daniels, Woodstock, Windsor county, Vermont, October 10.

This machine is, in its general features, similar to the paper engine

for dressing pulp in the manufacture of paper, excepting that the cylinder, instead of being armed with knives, is studded with teeth, and works against a concave of small rollers, also studded with teeth. The worn out cloths, or silks, may be first reduced into shreds by toothed cylinders, or other apparatus, and then put into the water, in which the lower part of the cylinder and the concave of rollers work, and thus brought under the action of the teeth, which take out the twist.

Claim.—"Having thus fully described the manner in which I construct my machine for reducing woolen rags and also worn out silks into fibrous stock, fit to be re-manufactured, it is to be understood that I do not claim the mere use of cylinders furnished with teeth, or points, for the purpose of tearing or reducing woolen or other rags into fibres, but what I do claim as constituting my invention, and desire to secure by letters patent, is the use of cylinders furnished with teeth or points, and operating under water, or other fluid, in a machine similar in its general form to that used by paper makers in preparing their pulp, but combined with the concave of small cylinders, and operating in the manner described."

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14. For an improved *Cooking Stove;* R. G. Cochran, Francistown, Hillsborough county, New Hampshire, October 10.

The patentee says, "that his improvement is in the manner of constructing a cooking stove, by which it is adapted to the heating of air, and to the conveying of air so heated for the warming of apartments in dwellings."

An air chest is made between the fire chamber and the descending flue, in front of the oven, so that the draught passes up in front of the air chest, over the top, down between the back of the air chest and front of the oven, &c. &c. Air is admitted to the air chest by a pipe at the side or bottom, and conducted out through a trunk which extends over the oven, and thence through a pipe to the apartment to be heated. The oven, when not used for baking, is employed as auxiliary to the air chest by being provided with a pipe to admit cold air into it, and an aperture, governed by a valve, for conducting the hot air to the trunk which conveys the hot air from the chest. These various pipes and apertures are to be governed by valves or dampers.

The patentee says, "I claim the manner in which I have combined and arranged the air chest for heating air with a cooking stove, rendering the oven or ovens of such stoves auxiliary thereto by converting them into air heating chambers, and connecting them with the air chamber first named, in the manner and for the purpose herein set forth."

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15. For an improved machine for *Working and Pressing Butter;* Titus D. Gail, Eden, Erie county, New York, October 10.

This machine is for working and pressing butter to separate it from the buttermilk and to press it into balls or lumps of definite size. The machine is described as consisting of a table pierced with two square

holes, fitted with pistons, working from below. Above these perforations a trough is formed by two side boards, in which work three pistons, one vertically and the other two horizontally, one at each end; the three being so connected that by pressing down that which is vertical, the others are forced apart, and when it is drawn up they are pressed together, and thus the butter is alternately worked and the buttermilk separated from it. The butter is then forced into the square holes, or boxes, to form it into balls, the size of which will be regulated by the pistons that work in said boxes.

Claim.—"What I claim is the combination of the horizontal pistons working within the side boards, and operated by the levers, and also the vertical block, or piston, attached and operated by the lever, likewise the table constructed with boxes, all as described; and in combination therewith the box or mould pistons and the slide, for the purpose set forth."

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16. For an improvement in the method of *Cutting Screws on the Rails of Bedsteads;* Jacob Lindley, Cynthiana, Harrison county, Kentucky, October 10.

The ordinary method of cutting screws upon the ends of bedstead rails, is well known to all who are acquainted with the making of such articles. In the improved mode, the rail is held in the middle by a clamp attached to a bench, on each end of which there is a puppet head in which works a screw, mandrel, or shaft, provided with a winch on its outer end, and on the inner end of each of these is fitted a socket, very similar to those usually employed for cutting wooden screws, excepting that they are made of steel, and the cutter is formed by it, instead of being attached thereto. These sockets are fitted on to the inner ends of the screw, mandrel, or shaft, by a socket, and secured by a thumb screw, by means of which the precise point at which the threads, on each end of the rail shall end, can be regulated. That end of the socket, on which the cutter is situated, is beveled off, and the cutter is so formed as to cut under the shoulder.

The claim is to the "manner of forming the cutters for cutting the screws on the ends of the rails, by making them a part of, and one with, the sockets, or female screws. Also, the manner in which I have combined and arranged these sockets, the screw shafts, and standards (puppets) with each other, for the purpose set forth."

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17. For a machine for *Pricking Leather preparatory to sewing;* Samuel Sheldon, Cincinnati, Hamilton county, Ohio, October 10.

This machine consists of a clamp for holding the leather, attached to a sliding carriage, and a slide to which the awl is attached, said awl having a sliding reciprocating motion at right angles to the motion of the leather in the clamp. The awl slide is moved by means of a crank pin on a wheel attached to the fly wheel shaft, and a strap, operated by the awl slide, passes over a roller and has a sliding plate suspended from it, provided with a pin which may be shifted along a set of holes; as the sliding plate is worked up and down by the strap, the

pin strikes against a handle and thus actuates a rag wheel, from which motion is communicated to the clamp carriage; the degree of this motion may be regulated by shifting the pin on the sliding plate, the distance apart of the holes pricked in the leather being thereby determined at pleasure. The motion of the awl and the leather may also be regulated by shifting the crank pin on the wheel, by which the awl slide is actuated.

The claim refers by letters to the drawings, but it is confined to the arrangements above indicated for regulating the feed which moves the carriage and clamp.

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18. For improvements in the *Machine for Pricking Leather preparatory to sewing;* Samuel Sheldon, Cincinnati, Hamilton county, Ohio, October 10.

The claim under this patent is to the "manner of combining and arranging the apparatus for moving the awl back and forth, as described, said combination consisting of the strap shaft, with the strap attached thereto, and the pinion thereon, taking into the rack on the awl shaft, the metal rods and the spring, substituted for the leather strap and the spring in his patent of August 3rd, 1839. And also to the manner of combining the screws and swivel-nuts with the clamp for holding the leather."

The difference between this and the first named machine is principally for the purpose of adapting it to the heavier kinds of work, such as thorough braces, &c.; the particular manner of effecting this we shall not attempt to describe.

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19. For improvements in the mode of *Supplying Steam Boilers;* Benjamin M. Hyatt, Wilmington, Delaware, October 10.

A cylinder is placed above the boiler, with one pipe leading from the bottom thereof nearly to the bottom of the boiler, another from the upper part of said cylinder to the top of the boiler, and a third either to a cistern above, or a well below. All these pipes are provided with stop cocks to be worked at proper intervals by the engine. When the third pipe connects the cylinder with a well below, the operation is as follows, viz: steam is admitted from the boiler to the cylinder through the first named pipe, and by its condensation forms a vacuum in the cylinder, which is to be filled with water from the well, by atmospheric pressure through the third pipe; steam is then again admitted through the first pipe, to make the pressure above the water in the cylinder equal to the pressure in the boiler, and the water in then admitted to the boiler through the second pipe. When the third pipe leads from the cylinder to a cistern above, instead of a well, steam is admitted into the cylinder only for the purpose of equalizing the pressure.

The patentee says, "I am aware that steam boilers have been constructed with a supply cistern, in some respects like mine, that is with a chamber or cistern placed above them having tubes governed by

stop cocks connecting the top and bottom of the cistern with the boiler for the purpose of equalizing the pressure of the steam upon the water and allowing it to descend into the boiler as herein described. I do not, therefore, claim the raising of water by the condensation of steam in a vessel for that purpose; but what I do claim is the combination for raising water and supplying a steam boiler therewith, as herein set forth; that is to say, by the use of the pipes leading from the cylinder into the boiler, combined with the respective stop cocks connected with the cylinder and the boiler, said cocks being operated by the stroke of the steam engine in any convenient way, so as to allow the steam in the cistern at every stroke of the piston to come in contact with the tube leading to the well, so as to produce a rapid condensation, and a consequent vacuum for the admission of water from the supply reservoir, or well.

I also claim the combination and arrangement as above set forth for supplying water to the boiler from the cistern, or from any sufficient source above the boiler, the combination and the action of the respective cocks by the power of the engine being in all respects as herein set forth, with the exception of the apparatus for raising the water from a well or reservoir below the boiler.

I wish to be understood, also, as not claiming in this the raising of water into a cistern connected with a steam boiler by atmospheric pressure, steam being admitted from the boiler into the cistern and condensed as in my arrangement, unless the mode of supplying the boiler from the cistern by balancing the pressure of the steam be employed as herein described."

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20. For an improved mode of *Propelling Boats on Canals;* Mellen Battel, Albany, New York, October 14.

The improvement proposed is in the well known mode of propelling canal boats by means of a wheel running on the bottom of the canal. The wheel is to be made with paddles, in the usual way, and there are to be projections on the outer edges thereof to catch and hold on to the bottom of the canal, so that in shallow water the wheel may be employed to run on the bottom, and in deep water to act merely as a paddle wheel. The wheel is placed between two boats, or between the sections of what is usually called a twin boat; it has its bearings in two vibrating balance beams, to which the engine is also attached, so that the wheel may accommodate itself to the inequalities of the bottom.

The claim is to the "forming of the combined ground and paddle wheel, so as to run upon the bottom of a canal and to propel the boat by the hold or friction of the cross bars and the rims alone, and when raised from the bottom to effect the propelling by the buckets, or paddles; said wheel being connected and combined with a vibrating frame within the body of the boat, which frame also sustains the steam cylinders in the manner set forth, and the respective parts concerned in the operation of propelling being arranged and operating substantially in the manner herein described."

21. For a *Cooking Stove for Burning Bituminous Coal;* Wm. B. Lawrence, Cincinnati, Ohio, October 14.

The patentee remarks that "one of the principal causes of complaint in the operation of baking in cooking stoves is the result of the accumulation of soot and ashes in the flues, which being very bad conductors of heat prevent the heating of the oven plates, the air from the fire making its escape without communicating its heat where alone it is wanted; to obviate this difficulty is the main object of my improvement.

"Said improvement consists, in the first place, in the forming of a scraper which may be cast in one piece, or which may be made by the uniting of several plates together so as to constitute one piece, and which, when in place, shall occupy the flue space above, below, and on each side of the oven, and shall have rods attached to it that pass through holes in one of the side plates of the stove, terminating in handles on the outside, in such manner as to admit of the moving of said scrapers back and forth within the flues, and simultaneously to remove the accumulated soot and ashes therefrom on every side. And secondly, for the purpose of discharging the soot which has been scraped off from the flues, I make perforations, or longitudinal openings, through the iron plate which forms the lower side of the bottom oven flue, and place under this plate a drawer, or other receptacle, into which the soot and ashes shall fall, and from which they can be readily removed whenever the same may become necessary."

The claim is to the "manner of cleaning the flues surrounding the ovens of stoves of various kinds by the use of a scraper, cast or otherwise made in one piece so as to surround the oven on four sides; and in combination therewith the respective openings in the bottom plate leading into the draw, or receptacle, for the soot and ashes."

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22. For an improvement in the *Spark Arrester for Locomotive and other Carriages;* Randall Fish, New York city, October 14.

In this spark arrester the usual chimney is surrounded by a drum divided into chambers by vertical partitions running from it to the inner periphery of the drum. The draught is conducted through a pipe into the first chamber, from this chamber into the next through a pipe in the partition, and so on until it has passed through all the chambers, from the last of which it is conducted back into the chimney through an opening near the top of the drum. The pipes that form the communications, from the chimney to the drum, and from chamber to chamber, are inclined downwards at an angle of about forty-five degrees. The drum is provided with a receptacle at the bottom to receive the sparks.

The claim, if given, would be merely a repetition of the foregoing arrangement, and we do not, therefore, insert it.

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23. For an improved *Ever Pointed Pencil Case;* Thomas Woodward, city of Brooklyn, New York, October 14.

The object of this improvement is to prevent the heads and points

of pencil cases from becoming loose, where they are screwed on to the body of the case, and this is to be effected by the introduction of a sliding bolt at top and bottom, which slides within the case and revolving tip, and catches into a notch made in the head and point for its reception. Instead of the bolt the patentee describes another method of preventing the point from becoming loose, which consists in forming a conical joint, instead of a square shoulder, on the point and revolving tip where the two are united together by a screw.

The claim is to the "employment of a bolt, or catch, formed and operating substantially as described, in combination with the ordinary screw for securing the heads and points of such cases, and also, in lieu of such bolt or catch, at the point and tip, the combining of the cone with the ordinary screw, in the manner and for the purpose set forth, and applied to the ever pointed pencil case."

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24. For an improvement in the manner of making the *Wheels of Railroad Carriages;* Albert Fuller, Providence, Rhode Island, October 14.

In this wheel the rim is to be cast with a chilled flanch, and the tread is sunk to receive a wrought iron tire, which is put on while hot, so that the contraction of the metal as it cools will secure it in place; and it may be further secured by bolts.

Claim.—"What I claim as my invention and desire to secure by letters patent is, placing the tire in the sink in combination with the cast iron chilled flanch, for the purpose and in the manner described."

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25. For a machine for *Cutting Vegetables;* George J. Neveil, Rising Sun, Philadelphia county, Pennsylvania, October 14.

The machine described by the patentee is for cutting vegetables for the feeding of cattle, and it may be applied also to other purposes; it consists of a hollow truncated cone, provided with cutters, and revolving on an horizontal shaft or axis within an inclined hopper provided with a sliding gauge on the side towards which the cutters revolve, for the purpose of aiding to regulate the cutting apparatus.

The general nature of the improvement will be understood by reference to the following claim, viz: "I do not claim a hollow truncated cone, inclined hopper, sliding gauge, or frame, but what I do claim as my invention, and which I desire to secure by letters patent, consists of the before described mode of constructing the hollow truncated cone of cutters for cutting vegetables, roots, &c., namely by means of the open and solid beads grooved on the faces towards each other to admit the ends of the segments and knives, and held together by rods and screws arranged in such a manner that they can be loosened at pleasure for the purpose of setting the segments nearer to or farther from the cutting edges of the knives, for the purpose of cutting coarser or finer and again tightened to hold them securely in the position in which they are set, all as described."

26. For a method of *Rendering Hats Buoyant, to be employed as Life Preservers;* Samuel White, England, October 14.

A water proof chamber is made in the upper part of a hat, cap, or bonnet, by means of a division placed sufficiently high to be beyond the reach of the top of the head. The whole of the hat, &c., is made water proof, and the lining is provided with a tube, so that by drawing out the lining, and inflating it with air, through this tube, the whole will have considerable buoyancy.

The claim is, "first, to the making of hats, caps, and bonnets with a space water proof, as above described. And secondly, to the application of a water proof lining for the purpose of preventing persons from sinking in the water.

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27. For an improvement in the *Cooking Stove;* James Parmalee, Ogden, Monroe county, New York, October 14.

The improvement claimed in this patent is for an arrangement of the dampers and plates to give a new direction to the draught. In addition to the front set of boilers usually employed in cooking stoves there is another set over the forward part of the oven. Between the bottom of these boilers and the top plate of the oven, there is a plate which extends from the back plate of the fire chamber to the back of the stove, and the passage between this plate and the top plate of the stove is closed, when desired, by a damper, and that between this plate and the top plate of the oven is closed by a partition running across the stove; the partition and the damper being behind the second row of boilers above mentioned. The intermediate plate is provided with two openings, one in front and the other behind the partition. When the oven is not in use the damper is to be turned down, and then the draught passes under the boilers and directly out to the smoke pipe near the back; but when the oven is to be heated, the damper is closed, and the draught then passes under the boilers, through the hole in the intermediate plate, over a part of the oven, down the front, under the bottom, up the back, then over the other part of the top, and through the second hole in the intermediate plate to the pipe. The claim is limited to this particular arrangement of the flues, partitions, and dampers.

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28. For a *Boiler for Heating Water for Culinary Purposes, and for Generating Steam;* Daniel L. Pickard, Hartland, Niagara county, New York, October 14.

The furnace in this apparatus is placed within the boiler, which may be cylindrical, and the space between the furnace and the cylinder, at the sides and top, is occupied by alternate flues and water chambers, formed by means of convolute plates, so that the draught passes up over the top of the first water chamber, on each side, down between the first and second water chambers, and up between the second and third, and thence out at the chimney, which chimney passes

through the outer water chamber. All the water chambers open into a water space at the end.

Claim.—"Having thus fully described the manner in which I construct my boiler, what I claim therein as constituting my invention, and desire to secure by letters patent, is the manner in which I have combined and arranged the respective parts, consisting of the exterior case, the furnace, the convolute flues and water spaces, and the end water space, or bulk-head, as described."

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29. For a *Machine for Crozing and Chiming Staves for Barrels, &c.;* Charles F. Beverly, Salem, Columbiana county, Ohio, October 16.

The croze and chime of staves are to be formed by this machine, on the face of the block from which the stave is to be cut. On the face of the gate, to which the knife, that cuts the stave, is attached, there are two cutters of the form of the croze and chime, placed as much farther back than the knife as will form the desired thickness of the stave; these cutters shear against the edge of a plate having depressions to correspond with their shape, said plate is attached to a sliding platform, which is acted upon by a spring to force the plate into its proper position to insure cutting, and by means of cam pieces, attached to the gate, between the stave knife and cutters, it is pushed back, clear of the stave knife, at each operation.

The claim is to the manner of forming the cutters, for cutting the croze and chime in combination with the depressions and bevels on the plate against which they cut.

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30. For improvements in the *Machine for Planting Corn;* Martin Nichols, Clearfield, Clearfield county, Pennsylvania, October 16.

The description of this machine is of great length, and the claims refer to the drawings, and could not be understood without them.

The corn, or other seed, is to be dropped by means of cups attached to a band passing around two drums, in a manner well known to those who are conversant with planting machines. Two rows are to be planted simultaneously, one on each side of the machine. The first claim is to the manner of arranging a plough beam, by attaching it, by a joint pin or bolt, at one end to the frame of the machine, and at the other end to a sword piece which passes up through a mortise in the frame—the depth to which it shall sink being regulated by a pin. The second claim is to the combining with the above a windlass and levers by means of which the plough may be raised, and a roller attached to the end of one of the levers, depressed, to relieve the plough and coverers.

The third claim is to the combining with the plough and coverers two stampers which stamp the earth after the rows have been covered —they are attached to levers and worked up and down by means of tappets on a revolving shaft.

The last claim is to the manner of arranging and operating a brush or striker for clearing the cups of any surplus grain. The brush is

attached to a vibrating lever operated by a grooved cam on a revolving shaft.

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31. For an improvement in the *Reaction Water Wheel;* Archibald Bryce, Campbelltown, Steuben county, New York, October 16.

Reacting water wheels have sometimes been so formed as to have the issues, or outlets for the water, near the periphery, and extending from top to bottom of the wheel, supposing the wheel to be horizontal, or they have been made to extend from the hub, or shaft, of the wheel, to the periphery, in a manner similar to the old tub wheel. The present wheel is a combination of these two, excepting that the bottom issues, or outlets, are gradually increased in size from the hub or shaft to the periphery, making them of a triangular form.

The patentee says—"What I claim as my invention and desire to secure by letters patent, is the combination of the inclined plane and triangular issue with the curved segment side, as described, by means of which arrangement the water is thrown to, and discharged at the periphery of the wheel instead of discharging the whole distance from the centre to the periphery as heretofore; and also the triangular issues in the bottom combined with the rectangular issue in the circumference of the wheel as set forth."

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32. For a mode of *Hauling off Stranded Vessels;* Thomas Bell, Bellport, Suffolk county, New York, October 22.

This patent is obtained for a peculiar arrangement of lines with buoys made fast to anchors and passing from the stranded vessel to another, which is to be properly secured by anchors. And also for attaching buoys to the stranded vessel to assist in floating it as it enters the water. The whole arrangement could not be understood without reference to the drawings; the claim, however, will afford a general idea of the plan.

Claim.—"I claim the manner of arranging and combining the large anchors, chains, and buoys, and of connecting them with the stranded vessel, with the chain, or rope, rove through said blocks so as to be acted upon by the windlass of the vessel. I claim in combination with the foregoing, the manner of employing the air tight buoys, attached to a vessel on a beach, for the purpose of aiding in giving her buoyancy, when being hauled off by the purchase herein described."

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33. For a mode of *Shifting Switches on Railroads;* Richard W. Sheckells, Baltimore, Maryland, October 22.

The switches which are the subject of this patent are to be shifted by the car. The two switches are connected with a bar which slides at right angles to the rails, and this bar is jointed to one or two levers on each side of the track, and these are acted upon by two keys jointed to a balance lever, or beam, in front of the car. The levers that are jointed to the switch bar are so curved that as the car approaches the switches, one of them will be acted upon by that key on the car which is down; their attachment by a joint to the balance lever, or

beam admitting of their being moved up and down by the engineer, so as to shift the switches to either side, as desired by him. The switch bar has two projections, one on each side, by which it is locked at each shift of the switches, the locking being effected by two springs, one acting on each projection, provided with a cam piece, so that in shifting the switches sufficient force must be applied to enable the projections on the bar to overcome the pressure of the springs and pass over the cam pieces thereon.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is not the principle of shifting the switches by means of a projection from the car acting against a lever connected with the switch, as this has long since been done, but what I do claim, is the method of connecting the switches with the sets of levers, one set on each side of the track, or one lever on each side of the track, in combination with the keys on the beam, in the manner and for the purpose described; and I also claim the mode herein described of locking the switches by means of the apparatus described."

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34. For an improvement in the *Machine for Knitting Stockings;* Benjamin Hutchinson, Jr., Springfield, Hampden county, Massachusetts, October 22.

This improvement is on the kind of knitting machine noticed in the second series of this Journal, vol. viii, p. 10, and vol. xx, p. 336. In the machine now in use and previously patented, as will be seen by the above references, the stocking was knit with an open seam; the needles, therefor, being ranged on a portion of the periphery of a wheel, standing up like cogs on a crown wheel; but the present improvement is for knitting the stocking with a closed seam, and the nature of the improvement will be understood by reference to the claim which is in the following words, viz:—

"Having thus fully described the manner in which I construct my knitting machine, what I claim therein as constituting my invention, and desire to secure by letters patent, is the employment of an endless chain of hooks, or turning needles, upon which the loops, or stitches, are to be received, which chain is so constructed as that it may be lengthened or shortened at pleasure, for the purpose of widening or narrowing in the process of knitting. The hooks, or turning needles, used by me are grooved on their upper surface, and are otherwise constructed in a manner similar to those used in the machines where the stockings are knit open. I do not, therefore, make any claim to these, or to the apparatus by which the yarn is lifted, tramped, or otherwise operated upon, but confine my claim to the endless chain, constructed and operating in the manner, and for the purpose set forth."

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35. For an improvement in the *Alarm for protection against Thieves;* Lester E. Denison, Saybrook, Middlesex county, Connecticut, October 22.

The improvement is applied to a money drawer, and consists of an

inclined plate, or ledge, on the bottom of a drawer, which, as the drawer is pulled out, actuates a lever which acts on a sliding plate that is connected, by means of rods and bell cranks, to a plate, called by the patentee a segment plate—this plate is hung on a joint pin and has a weight suspended to it at one end, whilst the other end catches on to the crank handle of an alarm and prevents it from ringing. The object of this arrangement is to disengage the segment plate from the crank of the alarm when the drawer is pulled out by any one not acquainted with the arrangement.

The claim is to the "combination and arrangement of the oblique plate, or ledge, on the bottom of the money drawer; with the vertical lever, horizontal plate, rods, bell crank, and segment plate for springing the alarm when the money drawer is moved."

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36. For a machine for *Hewing Plough Beams*, and which is applicable also to other purposes; Draper Ruggles, Joel Nourse, and John C. Mason, Assignees of Elbridge G. Mathews, Worcester, Massachusetts, October 22.

The hewing is performed by means of gouges affixed to the face of a wheel towards the edge thereof. The piece of timber to be hewed is placed on to a sliding carriage, which is put in motion by the machinery in any known manner. A pattern is fastened on the upper side of the timber, with the edge of the form desired placed towards the cutter wheel. The formed edge of the pattern, as the carriage moves along, is pressed against a permanent guide by a weighted slide having a roller on that end of it which presses against the pattern. The piece of timber is protected from the cutters on the ascending side by a guard piece.

The claim is to the "arrangement by which a timber to be hewed is presented to, and guided along before, the cutters, in such manner as that the cutters act upon and hew the side of the timber according to a board or edge pattern, in conformity with any desirable curve or curves given to the edge of the pattern, as above described, or in any manner analogous thereto."

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37. For a *Machine for Planing and Forming Ivory Comb Plates;* Julius Pratt, Fermer Bush, Aaron Pratt, and Zena K. Murdock, of Meriden, Connecticut, George Read, Alphus Starkey, George Spencer, and John C. Rogers, of Saybrook, Connecticut, Assignees of William M. Fowler, North Branford, New Haven county, Connecticut, October 23.

This machine consists of an annular plate, with teeth on the inner periphery thereof, attached to the edge of a hollow cylinder, connected with a shaft by a funnel shaped casing. The plates of ivory previously prepared in the rough, are presented by means of a pair of feed rollers, curved longitudinally to correspond with the curve of the cutter, ring, or plate. Two spring guides of the proper curvature

are placed in front of the feed rollers to insure the presentation of the plates in a proper manner to the rotating cutters.

Claim.—"I do not claim as my invention a circular cutter with teeth on the inner edge of the circle merely, nor do I claim merely the mode of feeding by rollers, but I do claim as my invention the application of a circular cutter having a diameter calculated to give the proper curve for planing and fashioning comb plates, in combination with the mode of feeding, or bringing plates to the operation of the cutter, substantially in the manner as above described."

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38. For an improvement in the *Rotary Temple for Looms;* George Draper, Palmer, Hampden county, Massachusetts, October 28.

The patentee says.—"The main difficulty with the rotary temple now in use, consists in the construction of the wheel which is provided with only one set, or row, of oblique teeth, as by this arrangement the teeth must necessarily run constantly on the same thread, which has a tendency, in weaving thin fabrics, to crowd the threads too much to the selvage of the cloth, and by so doing, leave an open track where the teeth have passed."

The improvement claimed is for the employment of two rows of teeth instead of one, the teeth in one row being opposite to the spaces between the teeth in the other row.

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39. For an improvement in the *Machine for Cleaning Wool from Burs, and Ginning Cotton;* Milton D. Whipple, East Douglass, Worcester county, Massachusetts, October 28.

The wool or cotton is fed into the machine by an endless apron, and feed rollers, it is then taken by the toothed cylinder and carried to a doffing cylinder which has a vibratory motion. This doffing cylinder has upon it one or two steel plates running its whole length, with teeth on one or both edges, about a tenth of an inch apart; they are brought to an edge from the under side, and they are still further raised from the surface of the cylinder by placing strips of paper or pasteboard under them. When the wool or cotton is taken from the toothed roller by the teeth on this vibrating cylinder, or doffer, it is stripped of the burs, or seeds, by a toothed plate, similar to those on the cylinder, attached to a guard plate above the cylinder.

The claim is to the "manner of applying and using the vibrating doffer, with its comb plates, constructed and operating as herein described, in combination with the toothed guard plate, as described; and this I claim whether the respective parts be formed exactly as herein represented, or in any other which is substantially the same, producing a like result by analogous means."

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40. For an improvement in the *Machine for Cutting Shingles;* Miles R. Payne, Andersontown, Madison county, Louisiana, October 30.

This patent is for an improvement on such machines as cut the shingles from a bolt by means of a knife, or knives, attached to a gate

which slides horizontally, and consists in the employment of two sliding dogs which hold the bolt whilst the knife, or knives, is cutting. These dogs are held against the bolt by means of weights, and they are pushed back by a cam piece on each side of the sliding gate.

The claim is confined to the sliding dogs in combination with the cams on the side of the gate.

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41. For an improvement in *Gaiter Boots;* John H. Duport and Theodore Hyatt, city of New York, October 30.

This improvement consists in a peculiar mode of making the spring gores employed in gaiter boots instead of lacings. These spring gores may be made of the same material with the boot, the gore being stitched, and shirred, so as to receive strips of India rubber, which render the gore elastic throughout. The strips of India rubber being attached at their ends, and operating like the wire springs of suspenders, &c.

After disclaiming the mere making of boots with spring gores, and with India rubber springs having shirred coverings, the patentees limit their claim to "gaiter boots made elastic by being constructed with an elastic gore, or gores, made from the combination of shirred materials and India rubber springs, substantially as described."

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42. For a *Machine for Cutting Cork;* Charles R. Macy, Hyde Park, New York, October 31.

The pieces of cork, called blocks, cut into proper lengths, are held between two revolving spindles which grip them, and as they revolve, the cork is cut round by a revolving cutter wheel, the arbor of which is horizontal and has its bearings in a sliding frame. This frame rests upon two cams, on a shaft parallel to, and under the shaft of the cutter wheel, the cams being of such form as that at the commencement of each operation the frame and knife will be lifted up, and cause the edge of the cutter wheel to approach the piece of cork to be cut, and when the cork has been cut, the frame and cutter wheel are let down to allow the revolving gripes to receive another block. The edge of the cutter wheel is kept sharp, during the operation, by means of two rotary disks, one acting on each face. The faces of these disks are covered with leather, and emery, or any other substance which will give an edge. As the cutter wheel revolves, to cut the cork, every part of its edge is brought around to these grinding disks. The blocks are fed in through a box, from which they are taken by a jaw which slides forward and places them between the gripes of the revolving spindles.

The claim is to the "combination of the rotary cutter wheels with the sharpening rotary disks, one on each face of the rotary cutter for the purpose and in the manner described.

"Secondly, to the method of moving the rotary cutter wheel up and down at the commencement and end of every operation by means of

the sliding frame, acted upon by the cams, for the purpose and in the manner described.

"And thirdly, to the method of feeding the machine with the block by means of the slide and jaw in combination with the receiving box and spindles as herein described."

The attempts at cutting corks by machinery have been numerous, and have uniformly proved failures; not that corks have not been cut by machinery, but because they have not been so well cut as by hand, and because the preparing and assorting of the blocks to be cut by the machine have required a degree of care and attention which are not repaid by the result.

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43. For *Clearing Snow from Railroads;* Joseph H. Moore, Worcester, and Benjamin Woodworth, Boston, Massachusetts, October 31.

This snow clearer consists of a drum having plates attached thereto spirally, from the middle towards each end, forming right and left screws of any desired number of threads, the depth of which will depend upon the breadth of the plates. This drum is situated in front of, and receives motion from a locomotive engine, and as it revolves and travels forward, the spiral plates take the snow and discharge it on each side of the track.

The patentees say, "our invention consists of the cylinder, or drum, with its shaft as above described, with the spiral plates, or snow clearers, constructed and attached to the drum, with a crank, or gear, wheel for driving or propelling the machine, as described, in connexion with a railroad engine for the purpose described."

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44. For a *Process of Preparing Tallow for the Manufacture of Candles;* John Kirkman, New York city, October 31, antidated July 2, 1840.

This process is for preparing tallow for hard candles by separating the oil, or elaine, therefrom without pressing. The apparatus used consists of a cask, with a partition, or false bottom, pierced with small holes, and placed within a short distance of its bottom. Sufficient water is to be put into the cask to cover the false bottom; and the tallow, after it has been boiled and settled in the usual way, is poured into the vessel whilst hot; and after being kept therein, at a proper temperature, for about twenty-four hours, it begins to seed, or grain; a cock in the cask, below the false bottom, is then opened which allows the water and also the oil to run out, the tallow remaining above the false bottom. The tallow thus prepared, we are told by the patentee, will make hard candles possessing all the qualities of those made from pressed tallow.

The claim is to the "method of separating the oily part of the tallow by means of setting the mass of tallow over water as above described, and drawing off the water and oil from the bottom."

45. For a machine for *Separating Garlic from Wheat;* Jona F. Barrett, North Granville, Washington county, New York, October 31.

The patentee says—"The principle upon which my machine operates is that of pressure, and of the friction of the grains against each other. The two being combined in such a manner as to produce the crushing of the garlic, smut, white caps, and other foreign matter by their attrition against the grain, and not by being rubbed against any thing of the nature of graters, points, or other asperities, on the interior of the machine, in which the agitation is effected. The pressure may be made in various ways, as by a high column of grain contained in a cylinder, or shaft, above the agitators, and pressing upon that portion which is subjected to friction by the agitators, or the grain may be pressed upon by a revolving or a stationary plate resting upon its surface.

"The grain to be cleansed is fed into a cylindrical vessel, within which it is subjected to pressure under, and by means of, a revolving plate, or disk, of weight sufficient to cause the garlic and all other substances less hard than the grain itself to be crushed by their attrition against the grain which is kept in motion by means of projecting pieces, which I call agitators, affixed to the bottom of the cylindrical vessel, and to the under side of the revolving plate, or disk."

Claim.—"Having thus fully described the nature of my invention and shown the manner in which I carry the same into operation, what I claim as constituting my invention, and desire to secure by letters patent, is the acting upon the grain by compression and attrition combined with a force sufficient to crush the garlic and other foreign matter, without breaking the grain itself, the same being effected in the manner herein set forth; that is to say by making pressure upon the grain subjected to attrition, either by means of a plate constructed as herein described, and revolving above it, and carrying agitators which co-operate with fixed agitators, as set forth; or by making the pressure by means of a column of the grain of sufficient height to effect the purpose, when combined with its agitation, by means of revolving and fixed agitators, arranged and operating substantially as set forth."

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46. For a method of *Protecting Trees from Canker Worms;* Daniel Newhall, Lynn, Essex county, Massachusetts, October 31.

This patent is for an improvement on the mode now in use of destroying the grub, and which consists of a trough placed around the tree, and containing oil, or other liquid, which is deleterious to the grub. The improvement is in placing a box over the trough, the edges of which extend below it, to prevent the dust and leaves from settling in the oil, or other liquid, and the wind from blowing it out. One or two of the sides of this box are hinged so as to give admission at the trough.

The claim is to the addition of "a roof or casing constructed as

described, in combination with a metallic trough for oil or other liquid suited to the object."

This seems to be a small affair for a patent; the placing of a lid, cover, or roof, to a trough, partakes about as little of substantial invention as could well be, to claim the sanction of the seal of the patent office.

Specifications of American Patents.

Specification of a Patent for an Improvement in the Manufacturing of Cloths of Wool, or Wool and Silk. Granted to Reuben Daniels, *Woodstock, Windsor county, Vermont, October 8th,* 1840.

To all to whom it may concern: Be it known that I, Reuben Daniels, of Woodstock, Windsor county, Vermont, have invented an improvement in the manufacturing of cloths of various kinds including those in which wool is the only material employed, and those into the manufacturing of which wool enters as an essential part thereof, and I do hereby declare that the following is a full and exact description of my new manufacture.

The improvement consists in the remanufacture of wool into cloths of various kinds, such as broad cloths, kerseymeres, sattinets, and others of a similar character, and into cloths in which the warp consists of cotton, silk, or other material, and the filling in whole or in part, of wool; or of cloths in which the cotton, silk and wool are mixed together, and are carded and spun in their combined state; all of which I have successfully essayed. The wool so remanufactured I obtain by taking worn out woolen goods of various kinds, and also worn out silks, and reducing them to their original state by means of machinery which I have invented for that purpose (and for which I have made application for letters patent, simultaneously with the present application) or reduced by means of any other machinery which will produce said fibres of wool in a state fit for remanufacturing into yarn and cloth.

I sometimes take such restored wool, and card, spin, and weave it, alone, or I mix it with fresh wool in proportion of, at least, one-sixth part of the restored wool to five-sixths of the fresh wool, and I, in either case, thereby obtain yarn or cloth equal in all respects to that which can be obtained from either fresh, or new, wool of the same degree of fineness, a result not heretofore obtained, and by which I am enabled to produce such cloth, and sell it at a price considerably lower than that of cloth consisting entirely of fresh, or new, wool; as it is a fact which I have established by full experience that the reproduced fibres of wool may be obtained from the worn out woolen goods, pound for pound, at a very trifling cost.

What I claim as my invention, or discovery, and desire to secure by letters, is the employment of wool and of silk obtained by the re-

ducing into the fibrous state of worn out woolen or silk goods, so as to produce new fabrics, by the operations of spinning and weaving, equal in all respects to those obtained from new, or fresh wool, said reproduced fibre to be used either alone or in proportion to that of the fresh wool of not less than one-sixth part.

REUBEN DANIELS.

English Patents.

Specification of a Patent granted to HENRY ELKINGTON, *of Birmingham, in the county of Warwick, for his invention of Improvements in Covering, or Coating, of Certain Metals with Platina; and also Improvements in Gilding Certain Metals, and in Apparatus used in such Processes.*—Sealed 17th February, 1837.

These improvements apply to the coating of metals with platina and gold, which is a new mode of gilding, intended to supersede the old practice of employing an amalgam of mercury and gold.

Platina, in the first instance, is to be dissolved in nitromuriatic acid. About ten ounces of nitric acid, and the same of muriatic acid, is required to dissolve one ounce of platina; and the combined acids must be kept at a gentle heat until the dissolution has been completely effected.

When this has been done, the liquid is to be evaporated to about half its quantity, and then three quarts of water added to it, with three ounces of bi-carbonate of soda, which is to be boiled until the soda is dissolved, and then one pound of bi-carbonate of potash added; after which the whole must be boiled together for half an hour.

A slip of brass, or copper, put into this solution, will experience little or no change in its appearance; but if a solution of gold be added to it, in proportions of from one to five pennyweights of gold to the quantity of the solution, then the gold and platina will attach themselves to the metal.

While this process is going on, the solution must be kept boiling, and the effect will be in proportion to the quantity of gold employed, and the continuance of the boiling. At first, the surface of the metal under operation, will appear of a bronze colour, but it will ultimately assume that of fine gold.

Another mode of gilding proposed, is by first coating the articles with platina in a metallic state, and then submitting them to immersion and boiling in the solution of gold. The effect will be the same nearly; the process only differing.

Under this head of the invention, the patentee claims the exclusive use of carbonate of potash, or soda, in solution with platina and gold, for the purpose of gilding the surfaces of metals.

An inferior mode of gilding is also mentioned, which is effected by boiling the articles in a solution of mercury, potash and gold; but this is only employed for articles of a less costly quality, and is substitut-

ed for an amalgam of mercury and gold, upon which it is an improvement, as a more ready, cheaper, and better mode of gilding.

The articles of jewelry thus gilt, may be coloured and lacquered, in the old way; that is, by the known processes, in which the patentee does not claim any novelty.

In order to preserve the platina, and gold, which may remain in solution after the gilding operation is done, it is proposed to evaporate the solution in a close vessel, by means of a vacuum, produced by an air pump. The particular form of this vessel, however, is unimportant, so long as it will effect the object proposed; which is to allow the metallic residuum to be preserved, and made capable of being employed for a future operation of gilding.

London Journal of Arts and Sciences, May, 1841.

Specification of a Patent granted to Bernard Aube, *of the city of London, for Improvements in the Preparation of Wool for the Manufacture of Woolen and other Stuffs, and in the process of Obtaining the Materials to be used for that purpose.*—[Sealed May 7th, 1840.]

In preparing wool for the manufacture of woolen and other stuffs, it is well know that large quantities of oil are used to facilitate the working of the wool in the preparatory processes through which it passes, and the descriptions of oil used are expensive. Now the objects of my invention are to use oleic acid, which is comparatively a cheap article of manufacture, possessing properties peculiarly adapted to the preparatory processes through which wool passes; and also by washing wool containing oleic acid in an alkaline solution, there will be a saponaceous product obtained applicable to the fulling of woolen cloth, which I prefer to oleic acid, following the ordinary processes by which the oleic acid would be washed away, in like manner to what is generally the case when washing and pressing out the oils used, and as heretofore practised.

I would here remark, that oleic acid is a fluid well known, and is the fluid product or acid obtained from fatty matters, when the two acids composing fatty matters are separated, and such separation is now largely practised by persons engaged iu the manufacture of what are called stearine candles, and the various processes for separating the acids are well known, and form no part of my invention; and oleic acid may be purchased in large quantities, particularly from manufacturers of stearine candles. And in carrying out my invention, in place of using oils, I use such fatty acid called oleic, or tallow oil, and using the same intimately with the wool in a similar manner to that usually resorted to when employing the oils now used; and the workmen will judge by the working of the wool whether he has applied sufficient oleic acid or not, in the manner as he now judges whether he has applied sufficient oil, by the manner in which the wool under operation works, because it is well known that different wools require different quantities of oil, and therefore no exact quan-

tities can be given, and different workmen use more or less oil in working the same descriptions of wool. All that will therefore be necessary to state is, that in using oleic acid for the oils now employed, the workmen will judge by the freedom with which he can work the wool, and will use more or less of the oleic acid. When removing the oleic acid from the wool or fabrics made therefrom, it may be accomplished by the same means as heretofore practiced when the oils now employed have been used; but I prefer that the water used should have an alkali dissolved therein, so as to convert the oleic acid into a saponaceous product, which will be found particularly useful for fulling woolen cloths in place of soap; and for this purpose I dissolve about one half by weight of soda of commerce (which is the alkali I prefer, but I do not confine myself to that alkali,) of the weight of the oleic acid known to have been used in preparing the quantity of wool which is now to be treated, and such quantity of alkali is to be dissolved in a quantity of water about twice the weight of the wool to be cleansed. Although I am thus particular in giving quantities, I do not confine myself thereto, as they may be varied, but the quantities stated are those which I have used. By thus using an alkaline solution as the material for washing out the oleic acid from the wool, in addition to getting rid of the oleic acid, I also, as above stated, obtain a product very suitable for fulling woolen cloths.

Having thus described the nature of my invention, I would have it understood that what I claim is, first, the mode of preparing wool by the use of oleic acid in such processes.

And secondly, I claim the mode of preparing wool by the use of oleic acid, when combined with the removing it therefrom by means of an alkaline process, as described.

Repertory of Patent Inventions, July, 1841.

Specification of a Patent granted to THOMAS MACGAURAN, *of the County of Middlesex, for Improvements in the Manufacture of Paper from a Material not hitherto so employed.*—[Sealed August 26th, 1840.]

The invention consists in manufacturing paper from the hop-bine, which may be used as a substitute for the pulp of linen or other rags, or it may be used mixed with linen rags, or any other suitable material, if desired.

I will now describe the mode of preparing the bine, in order to render it suitable for the manufacture of fine paper. I take the bine after the hops are removed, and after bruising the stalk by passing it through rollers, or by any of the ordinary means (used for bruising hemp and other fibrous plants,) and cut it into small pieces of one or two inches long. I then place these pieces to soak in rain or river water, where they should be allowed to remain immersed in water for about twenty-four hours; they are then to be well washed, without breaking the pieces, in the ordinary washing engine (that being well known to paper makers, I have not thought it necessary to des-

cribe it,) this washing should continue until the water passes away perfectly clear; during this part of the process the roller should not touch the plate. When it is well washed I stop the water from passing through, and let down the roller on to the plate, and beat the bine until no splints or white chips appear. It is then to be taken to a press and to be subjected to pressure until nearly dry. It is then to be put into a cistern, which I prefer should be of stone, or lead, containing chloride of lime; and I use about 10 lbs. of chloride of lime to 100 lbs. of bine, in which it should be immersed for twenty-four hours. It is afterwards cleansed from the chloride of lime by a stream of water passing through the cistern. It is then to be subjected to the operation of an ordinary beating engine. The rougher the surface of the blade and plate of such engine is, the better. It is then triturated and beaten into an impalpable pulp. I take this pulp and submit it to the same process as just described. It will then be in a fit state to be manufactured into fine paper. In making coarse paper the process is the same as above described, with the omission of that part of it which applies to the reducing it to an impalpable pulp, that not being necessary. The paper may be bleached by any of the ordinary well known means.

Having thus described the nature of the invention and the manner of performing the same, I would remark that I do not confine myself to the mode herein described of preparing the bine, though I believe it to be the best for the purpose; but what I claim as this invention is the manufacturing paper from the hop-bine, either by itself, as a substitute for linen or other rags, or it may be mixed with them, or other suitable material, for the purpose of making paper. Ibid.

Progress of Practical & Theoretical Mechanics & Chemistry.

Upon the Application and Use of Auxiliary Steam Power, for the purpose of shortening the time occupied by Sailing Ships, upon distant voyages. *By* Samuel Seaward, M. Inst. C. E.

But few years have elapsed since the possibility of propelling vessels by the power of steam was treated as a chimera; and although the practicability of its application for short voyages has been successfully demonstrated, by the numerous vessels plying between this country and the continent, it is but of very recent date that its employment for long sea voyages has been adopted. The weight of the powerful machinery and the fuel, and the consequent loss of space for cargo, together with many other circumstances attendant on the present construction of steam vessels, induced the author (who received the education of a seaman, and has since had extensive practice as an engineer) to believe that a more efficient mode of employing steam power, for long sea voyages, might be adopted.

Notwithstanding the great improvements which have taken place in the construction of steam vessels, and their machinery, it would

appear that the duration of the voyage ought not to exceed twenty days, after which time a fresh supply of fuel becomes necessary; hence, steam has rarely been adopted for very long voyages. The reason of this limit to the duration of the voyage of a steam vessel, as at present equipped, is that an increase of power does not produce a corresponding increase of speed, while the weight of machinery increases in proportion to the power employed, and in some cases exceeds it; for instance, small engines, with the water in the boilers, generally weigh about one ton per horse power, while in some large engines the ratio is nearly twenty-five cwt. per horse power.

A quadruple increase of power will not produce double the original velocity in a steam ship, although, in theory, such is assumed to be the case; for, as the weight is more than double, the immersed sectional area becomes greater, and a still further increase of power is necessary. It has been shown by experience, that if a vessel, with a given power, is propelled through the water at the rate of eight miles per hour, her speed cannot be doubled, even though the power be multiplied twelve times, and the entire hold of the vessel be occupied as an engine room.

The weight of fuel is also in direct proportion to the size of the engines; so that taking for example, two vessels of two hundred and of four hundred horses power respectively—that of the higher power will have to carry nearly double the weight, both of fuel and of engines, and it is still questionable whether the increased force will propel the one ship more than one and a half miles per hour faster than the other.

The space occupied by the engines and fuel, in the most valuable part of the ship, is also an important consideration: neither the "President" nor "British Queen" steamer, although of two thousand tons measurement, is capable of carrying more than five hundred tons of cargo, when the fuel is on board.

The author then examines the question of employing too much power in a steam vessel, and refers to the "Liverpool," as an instance that such may be the fact. It appears that with the original dimensions of thirty feet ten inches beam, and engine power of four hundred and fifty horses, being a proportion of power to tonnage of about one to two, and one-fourth the vessel was immersed four feet beyond the calculated water line, and a decided failure was the natural consequence; but when the breadth of beam was increased to thirty-seven feet, augmenting the capacity of four hundred tons, and giving the proportion of one horse power to three and three-fourths tons burthen, the performance of the engine and the speed of the vessel were both materially improved.

The "Gem," Gravesend steamer, one hundred and forty-five feet long, by nineteen feet beam, had two engines of fifty horses power each; the speed was insufficient, being only twelve and a half miles through the water; but when the same engines were placed in the "Ruby," which was one hundred and fifty feet long, and nineteen feet nine inches beam, the velocity of the latter vessel was thirteen and a half miles per hour. A pair of engines, of forty-five horses

power each, were then placed in the "Gem," without altering the vessel, and in consequence of the diminished weight and draught of water, her speed then nearly equalled that of the "Ruby."

The author does not condemn the application of considerable power for vessels, providing it can be employed without materially increasing the weight and the area of the immersed midship section. It appears that the length of a steam voyage, to be profitable, is at present limited to twenty days for the largest class of steamers; that we have about thirty others which can approach twelve days, while the majority cannot employ steam beyond eight days successively, without a fresh supply of fuel. It is evident, therefore, that more efficient means must be adopted for the general wants of commerce in our extended intercourse with the East and West Indies, the Pacific, Mexico, Brazil, Australia, and all the distant colonies, which now demand rapid communication with England.

The author refers to a pamplet, published by him in 1827, entitled "Observations on the possibility of successfully employing Steam Power in Navigating Ships between this country and the East Indies by the Cape of Good Hope." He therein proposed that large square-rigged ships, of fifteen hundred to eighteen hundred tons measurement, should be fully equipped and constructed so as to sail ten or eleven miles per hour with a fair wind; that they should carry engines of small power, to assist the sails in light winds,—propel them at a moderate speed during calms,—work into and out of harbour, &c.,—and thus shorten those portions of the voyages wherein so much time was usually lost.

To all well built good sailing vessels, of four hundred tons and upwards, "auxiliary steam" is applicable. A steam engine of the necessary power, can, without inconvenience, be placed in such vessels, either on or between decks, so as to propel a ship at the rate of four to five nautical miles per hour in a calm, and for this speed a proportion of one horse power to twenty-five tons is amply sufficient. The practicability of applying this system to East Indiamen and other similar vessels, is then examined at length, and it is shewn that the ordinary speed of these ships under sail, is, before the wind, eleven to twelve miles per hour, and in a gale thirteen to fourteen miles per hour, which is greater by two or three miles per hour than that of any ordinary steam vessel when under sail, on account of the latter being impeded by the wheels trailing in the water, and the slightness of their masts, spars, and rigging. The auxiliary steam power might, therefore, be efficiently applied, either by using it alone, or in conjunction with the sails, so as to keep up a uniform speed, by which a great saving of time could be effected in a long voyage.

The conditions of sailing and steaming voyages to India, with the influence of the trade winds, are then examined, and the author proceeds to detail the experiments made by him, on board the "Vernon" Indiaman, which was the first sailing vessel that actually made a voyage out and home with "auxiliary steam."

The "Vernon," built in 1839, by the owner, Mr. Green, was one thousand tons burthen; the sailing speed was about twelve to thirteen

miles per hour in a fresh gale, and being from her frigate build well calculated for the experiment, it was determined to equip her with a condensing engine of thirty horses power, placed midships on the main deck, between the fore and main hatchways; the space occupied being twenty-four feet long by ten wide. The weight of the machinery was twenty-five tons, and it was so arranged that the motion was communicated direct from the piston cross-head, by two side rods, to the crank on the paddle shaft, placed immediately behind the lower end of the steam cylinder, which was horizontal. The wheels were fourteen feet diameter, projecting five feet, and were so constructed that the float boards could be raised to suit the draught of water of the ship; or they could be taken entirely away, if necessary, leaving the shafts projecting only eighteen inches beyond the sides. Under ordinary circumstances they were disconnected from the engine by a simple contrivance, consisting of a movable head, attached to the crank on the paddle shaft, by turning which, one quarter of a circle, the crank pin was liberated, and the wheels turned freely round. The "Vernon," thus equipped, having on board nine hundred tons of cargo, and sixty tons of coal, drew seventeen feet of water. In the first trial the speed of the vessel, under steam alone, was five and three-quarters nautical miles per hour, demonstrating how small a power is necessary for a moderate speed. She then started for Calcutta, and though the piston rod broke three times during the voyage, owing to a defect in one of the paddle shaft bearings, the passage was satisfactory. The details are given minutely, as are also those of the homeward voyage, which was performed from Calcutta to London in eighty-eight days, to which must be added seven days for necessary delay at the Cape, making a total of ninety-five days, which is the shortest passage on record. Great credit is given to Captain Denny for the judgment with which he used the auxiliary steam power, and the course taken by him, by which he was enabled to overcome the difficulties incidental to a first trial of so important a system. The success of the "Vernon," induced the immediate application of engine power to the "Earl Hardwick" Indiaman, and both these vessels are now on their voyage out to Calcutta.

For the purpose of demonstating the ratio of power to velocity, a Table was also given showing the velocities of ships of different tonnage, having steam power of various ratios, deduced from upwards of one hundred experiments on large steam vessels.

It was shown, that an engine of thirty horses power would propel a ship of twelve hundred tons burthen, at the rate of four knots per hour, while three hundred horses power would only propel the same ship at the rate of ten and five-ninths knots per hour. Hence, ten times the power would only produce about two and a half times the speed.

The principal points in the paper were more fully dwelt upon, and, in answer to questions from some of the members, Mr. Seaward remarked, that no steamer in England had ever been propelled at more than fifteen geographical miles per hour, through still water.

In some of the Government mail packets, the engines and coals were the full cargo of the vessel. The table did not apply to vessels

overladen with power, for as the weight increased in the ratio of the power, so the immersed sectional area was augmented, and the lines of the vessel, which might be well calculated for speed when at a proper draught, became lines of retardation, and the engines did not work up to their proper speed, owing to the depth to which the paddle floats were immersed. For instance:—The wheels of the "British Queen" have been plunged between six and seven feet, instead of four feet, which was the calculated dip; the engines at the same time diminishing their speed so much as to reduce the effective power from five hundred horses to nearly three hundred horses.

The only advantageous way in which great power could be applied, would be by contriving to prevent the increase in the weight of the machinery and fuel, and those engineers would be most successful who could so apply the materials of construction, as to ensure strength without the usual corresponding increase of weight.

Mr. George Mills, from his experience as a ship-builder, at Glasgow, was enabled to confirm all that Mr. Seaward had advanced. On the Clyde, the employment of an excess of power in steam vessels had been carried to the greatest extent, without producing corresponding advantages, either for speed, or in a commercial point of view. It would appear that the same error had, to a certain degree, been committed on the Thames, but less than on the Clyde; for on the latter river there were vessels with nearly double the power, in proportion to the size, as compared with any vessel on the former river. He believed that on the Thames no vessel had so much as one horse power for each register ton, whereas on the Clyde, there were steamers of seventy to eighty tons register, having single engines, with cylinders of fifty-four inches diameter, which was more than one hundred horses power. It would appear that this application of extra power had only obtained a very moderate speed, while the great first outlay, with the commensurate current expenses, had reduced the commercial profit to the lowest point,—of this the proprietors alone could give any account; but as to the speed attained, he had seen three steamers of identical tonnage leave the Broomielaw at the same time, their engines being respectively of one hundred and ten, eighty, and sixty horses power; yet their speed was in the inverse ratio of their power: the vessel with the smallest engine arrived at Greenock first, the greater power second, and the greatest last. These remarks were only applicable to river boats. With regard to sea-going vessels, the system had not been carried to so serious an extent, yet with them the average proportion was about one horse power to two register tons, and some few reached as high as one horse to one and one-eighth of a ton.

As an example of an augmentation of power producing an opposite result from that which was intended, Mr. Mills mentioned two vessels called the "Tartar" and the "Rover," built by him and his (then) partner, Mr. Charles Wood. They were each of about two hundred and twenty tons register, built from the same draught, and in every respect as similar as possible—except that the engines, which were by the same maker, were respectively of one hundred and seventy,

and one hundred and thirty horses power; yet whenever they worked together, the one with the smaller power proved herself the faster vessel, either in a calm, with the wind, or even against it. The "Achilles," Liverpool steamer, which lately had an addition of thirty feet to her length, and eighteen inches to her breadth, augmenting the tonnage about one-fifth, had improved her speed upwards of one mile per hour, although she carried a much heavier cargo than before.

He had built a vessel of five hundred and sixty tons register, with engines of one hundred and thirty horses power on board—a proportion of power to tonnage of one to four; the stowage for cargo was ample; the accommodation for passengers excellent. She drew little water, and her speed was much greater than vessels of double her power. Yet in spite of all this, the vessel could not find a purchaser, because the power was not nominally large.

It would be asked—why, with these and so many similar instances, such a system was continued? It was not likely that the engineers would complain of having orders for large engines; and there were certain dimensions prescribed for the vessel, to which the ship-builder was under the necessity of conforming.

The chief cause of mischief, however, was the fiat of the public. It was believed that a great power would remedy want of speed and all other evils, and it was found indispensable for ensuring the confidence of travellers. Hence, the shipowners, who depend upon the public for support, were obliged, against the conviction of their experience, to keep up the errors occasioned by ignorance.

The President observed, that the condemnation of large power should not be carried too far, as experience alone had produced the increase of weight, strength, and power. of the present engines, compared with those of the early steamers which were built, instancing the Halifax Packets (Cunard's,) which with their great power in proportion to tonnage, had performed their duties satisfactorily.

Mr. Mills explained that the Halifax Packets were built for the especial purpose of carrying the mails only, to perform the voyage in a given time,—about twelve days. The engines were built by Mr. Robert Napier, after the model of those of the "Great Western," which used their steam expansively; similar provisions had been made in the Halifax Packets, but the expansion valves were seldom used.

Mr. Field agreed with the principal part of Mr. Seaward's paper, but he would prevent an erroneous conception of the term *overpowering* a steamer. A vessel could not have too much power, provided that power could be advantageously applied, without causing too deep an immersion. A good result could be produced only by keeping a proper proportion between the machinery, the vessel, and the paddle wheels, and immersing the hull of the steamer only as deep as the true lines of draught.

Mr. Vignoles observed, that in this country the reputation of engineers depended upon the commercial success of the works they engaged in. An erroneous public opinion might have influence at present; but if the engineer and ship builder would determine to break these trammels, and produce such vessels as should force conviction upon

the public mind by the speed attained, and show the proprietors the consequent commercial advantage, the present system would soon be abandoned.

Mr. Parkes eulogized Mr. Seaward's candour in describing the errors in the first construction of the engine on board the Vernon; more was frequently to be learned from failures than from successful efforts, and no communications to the Institution would be so useful as those which gave accounts of defective design or construction, with the details of the methods adopted for remedying the defects. He directed attention to the performances of the "Great Western" steam ship, which at least equalled those of the Halifax Packets, without the disadvantages of being unable to carry cargo, or of shipping so much sea, when the weather was foul. The important feature of economy of fuel on board the "Great Western" might be in part attributed to the use of steam expansively. It was very desirable that the Institution should possess very full drawings and a description of the "Great Western," so as to be enabled to compare them with those of the Halifax Packets, which had been promised by Mr. George Mills. He would impress upon manufacturers of marine engines the necessity of adopting a correct and uniform nomenclature of the power placed on board steam vessels. The nominal selling power did not accord with any calculation.

Mr. Field believed the Table of Velocities calculated by Mr. Seaward to be very nearly accurate. The speed of the "Great Western," when loaded to her proper draught, had been as high as $13\frac{8}{10}$th miles through still water. There was an error in the alleged speed of Cunard's vessels; they reached Halifax in ten days, Boston in three more, and then had still one day's voyage to New York. The average duration of the voyages of the "Great Western," was about fourteen days and a half. If two hundred tons were deducted from the tonnage of the "Great Western" for cargo and the accommodation for the passengers, she would then be similar to the Halifax Packets. The engines of the "Great Western" were nominally estimated at four hundred horses power, and the average consumption of fuel was twenty-six tons every twenty-four hours.

During the discussion, Mr. Cubitt had calculated the following Table, showing the rates of velocity which would be attained by substituting engine power, with its consequent weight of one ton per horse power, for cargo, so as to preserve the draught of water the same in all cases.

Mr Seaward remarked, that his Table of power and velocities was corroborated by Mr. Cubitt's—the practical results verified both. The great difference between the "Great Western" and the Halifax Packets, consisted in the better adaptation of weight and power to tonnage, and the more economical consumption of fuel of the former over the latter—the one carrying cargo and passengers, the other only the engines and fuel, yet the "Great Western" traveled farther with the same quantity of fuel.

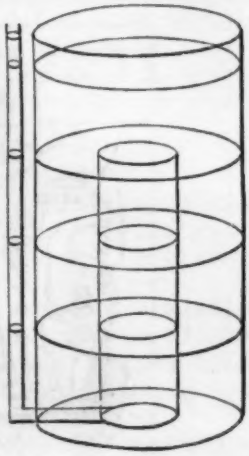
Table showing the power required to obtain various rates of speed in a steam vessel, where the total weight of cargo and engines remains in all cases the same, and in which, with a power of 30 horses, a speed of five miles per hour is obtained; and the total weight carried being in all cases 1000 tons, and the engines weighing one ton per horse power.

Weight of Cargo.	Weight and Power in Tons and Horse Power.	Relative Speed.	Speed in Miles per hour.
970	30	$5\sqrt[3]{1}$	5.
940	60	$5\sqrt[3]{2}$	6.299
910	90	$5\sqrt[3]{3}$	7.211
880	120	$5\sqrt[3]{4}$	7.937
850	150	$5\sqrt[3]{5}$	8.549
820	180	$5\sqrt[3]{6}$	9.085
790	210	$5\sqrt[3]{7}$	9.564
760	240	$5\sqrt[3]{8}$	10.
730	270	$5\sqrt[3]{9}$	10.4
700	300	$5\sqrt[3]{10}$	10.772
670	330	$5\sqrt[3]{11}$	11.119
640	360	$5\sqrt[3]{12}$	11.487
610	390	$5\sqrt[3]{13}$	11.756
580	420	$5\sqrt[3]{14}$	12.050
550	450	$5\sqrt[3]{15}$	12.331
520	480	$5\sqrt[3]{16}$	12.599
490	510	$5\sqrt[3]{17}$	12.856
460	540	$5\sqrt[3]{18}$	13.103
430	570	$5\sqrt[3]{19}$	13.34
400	600	$5\sqrt[3]{20}$	13.572
370	630	$5\sqrt[3]{21}$	13.794
340	660	$5\sqrt[3]{22}$	14.01
310	690	$5\sqrt[3]{23}$	14.219
280	720	$5\sqrt[3]{24}$	14.422
250	750	$5\sqrt[3]{25}$	14.62
220	780	$5\sqrt[3]{26}$	14.812
190	810	$5\sqrt[3]{27}$	15.
160	840	$5\sqrt[3]{28}$	15.182
130	870	$5\sqrt[3]{29}$	15.3615
100	900	$5\sqrt[3]{30}$	15.535
70	930	$5\sqrt[3]{1}$	15.706
40	960	$5\sqrt[3]{32}$	15.854
10	990	$5\sqrt[3]{33}$	16.037

London Journal of Arts and Sciences, July, 1841.

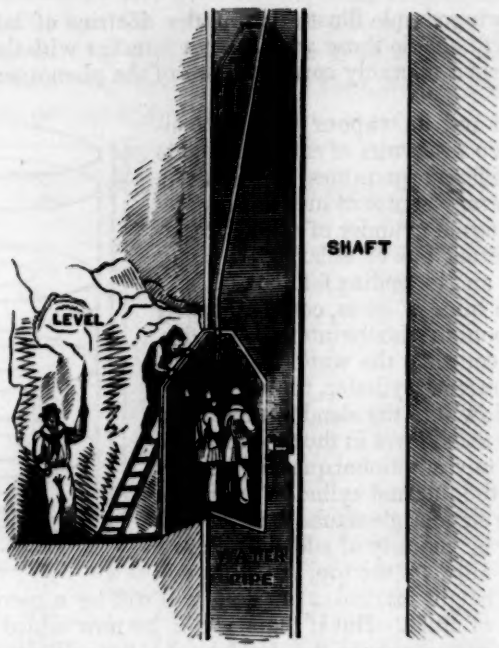
Simple Illustration of the Doctrine of Latent Heat. By Dr. Dalton.

The following simple illustration of the doctrine of latent heat by Dr. Dalton will enable those who are not familiar with the operations of heat to form a tolerably correct notion of the phenomenon in question:



The liquid and its vapour may be considered as two reservoirs of caloric, capable of holding different quantities of that fluid. Let the figure represent to us such an arrangement; the internal cylinder of smaller capacity, the external one of enlarged capacity surrounding and extending far above it, and a small open tube of glass, communicating freely at the bottom with the internal cylinder. Let us now conceive the water to be poured into the internal cylinder, the water will manifestly flow into the slender tube till it stand on the same level in the tube as in the cylinder. If any additional quantity be now poured into the internal cylinder, the rise of water in the slender glass tube will serve as an index of the quantity of added fluid; and when it is filled to the top, the fluid will stand at the height marked 212°, and will still be a correct index of the addition of fluid. But if more water be now added to it, it will not make its appearance in the slender tube, but will simply overflow from the internal cylinder over into that of enlarged capacity, so that while a large quantity is passing into the vessel and gradually filling it up to 212°, no additional rise takes place until the whole of the outer cylinder becomes filled to that point, after which any further addition will again become sensible, by a corresponding rise in the tube. This process is in precise analogy to the succession of circumstances in heating a liquid, and converting it into steam. The internal cylinder represents the liquid, the external one the vapour of greater capacity, and the slender glass tube at the side the thermometer placed in communication with them. When heat flows into the liquid, it passes equally into the thermometer; and each increment of the one produces an equal increment in the other, until the liquid reaches the limit of its capacity, when it suddenly begins to enlarge its bulk and take the form of steam; but the quantity of heat required to fill up this enlarged capacity is so great, as to require about 5½ times as much to fill it as was contained in the whole liquid before, so that all this time the thermometer is standing still, and it is not until the whole of the steam is thus supplied with 212° of caloric, that the thermometer will begin to show any further elevation; after which, any increment of heat thrown into the steam will make its appearance on the thermometer, and proceed as formerly, by simultaneous increments.

New Plan for Raising and Lowering Miners.



A cast-iron, or other, tube of sufficient strength, filled with water, is to be placed in the shaft, and extending from the bottom to the top of the mine; in this air-tight boxes are to be immersed. For ascending, of course, they must be a little lighter than the water, and, for descending, the admission of a small quantity of water will be sufficient, of course depending upon the velocity wished for. At whatever place it is required to stop, whether at the middle or at the bottom, a lock must be provided, into which these air-tight subaqueous miners' omnibuses may be conveyed; and, communication being cut off from the upright pipe, the miners may, on opening a door, disembark in safety. If it should be found that there was not sufficient air in the box for the ascent or descent, a flexible air-tube might be attached to it, which, by having a suitable weight to it, might travel along an inclined piece of ground near the mouth of the shaft. As there would always be some little loss of water in the opening and shutting of the locks when ascending, instead of admitting water from the main tube, before opening communication, the lock should be filled, from some small running in the mine at that level, and so save extra pumping. In these operations there would be no expensive machinery, no power to maintain—the opening and shutting of the locks would be the only things to attend to.

CAROLUS.

"*An account of some experiments to determine the force necessary to punch holes through plates of wrought Iron and Copper.*" *By Joseph Colthurst. Read before the Lond. Inst. Civil Engrs.*

These experiments were performed with a cast-iron lever, 11 feet long, multiplying the strain ten times, with a screw adjustment at the head, and a counterpoise.

The sheets of iron and copper which were experimented upon were placed between two perforated steel plates, and the punch, the nipple of which was perfectly flat on the face, being inserted into a hole in the upper plate, was driven through by the pressure of the lever.

The average results of the several experiments which are given in a detailed tabular form, show that—

The power required to force a punch—

Inch diam.	Through an iron plate	Inch thick.	
0.50	ditto	0.08	is 6,025lbs.
0.50	ditto	0.17	is 11,950lbs.
0.50	ditto	0.24	is 17,100lbs.
	Through a copper		
0.50	plate.	0.08	is 3,983lbs.
0.50	ditto	0.17	is 7,883lbs.

Hence it is evident, that the force necessary to punch holes of different diameters through metals of various thicknesses, is directly as the diameter of the holes and the thickness of the metal.

A simple rule for determining the force required for punching, may thus be deduced.

Taking one inch diameter, and one inch in thickness, as the units of calculation, it is shown that 150,000 is the constant number for wrought iron plates, and 96,000 for copper plates.

Multiply the constant number by the given diameter in inches, and by the thickness in inches; the product is the pressure in pounds, which will be required to punch a hole of a given diameter, through a plate of a given thickness.

It was observed that duration of pressure lessened considerably the ultimate force necessary to punch through metal, and that the use of oil on the punch reduced the pressure about eight per cent.

Mining Journ.

New Shoe for Horses.

A Frenchman of the name of Jony, who is at present resident in Poland, has invented a new method of shoeing horses, for which the Emperor has awarded him 50,000 rubles, besides an exclusive patent. Jony covers the entire hoof with iron, and the base of his shoe, or as it is called, the sandal, is perfectly smooth. This method of his is being adopted in all parts of Russia. It requires neither nail nor screw; it is extremely cheap; and has the important characteristic of great lightness. Horses, whose hoofs have been destroyed by bad shoeing, are, by the use of these "hippo sandals," restored in a short time to their former state of efficiency, and may be used as soon as they are provided with them.

Lond. Mech. Mag. Feb. 1841.

Manufacture of Carbolein.

The manufacture of this new kind of fuel, invented by M. Weschinskoff, of St. Petersburgh (which we have before noticed,) is thus described in the *Moniteur Industriel*:—"It is composed of coal, or of any other combustible, pounded as fine as possible, and mixed with a sufficient quantity of animal or vegetable oil; this mixture is subjected to a strong pressure, in order to produce pieces as hard and solid as stone; from an equal weight this carbolein yields five times more heat than common coal of the best quality. The flame which it produces is very bright, and burns for a long time; this property will render it extremely valuable in foundries, in the manufacture of arms, and in glass works, &c. In short, it will be useful for all purposes where it is important to obtain quickly a hot and continuous fire. It appears from the results of its use on the steam-ship *Sirius*, that the paddle-wheels which made twelve revolutions in a minute with the best coal, made nineteen in a minute when carbolein was used. This new combustible appears then to be very useful, and deserves that further experiments should be made in order to ascertain the accuracy of the results, which are stated to have been arrived at in the experiments already made.

Mining Journ.

Meteorological Observations for October, 1841.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	46	64	29.90	30.00	NW.	Moderate.		Clear—do.
	2	46	56	30.14	.15	NE.	do.		Cloudy—do.
	3	44	42	29.86	29.96	E.	Brisk.	1.78	Rain—do.
	4	42	55	.86	.86	W.	Moderate.		Cloudy—clear.
	5	40	57	30.00	30.03	W.	do.		Clear—do.
☽	6	40	58	.03	.00	NW.	do.		Clear—do.
	7	42	58	.00	29.90	NW.	do.		Clear—do.
	8	52	59	29.80	.76	W.	do.	.07	Cloudy—rain.
	9	50	63	.76	.80	W.	Brisk.		Clear—flying clouds.
	10	44	60	30.00	30.04	W.	Moderate.		Clear—do.
	11	42	64	.04	29.96	SW.	do.		Fog—hazy.
⊗	12	57	62	29.80	.75	SW.	do.	.57	Rain—cloudy.
	13	49	57	.86	.90	NW.	do.		Clear—flying clouds.
	14	40	51	30.00	30.05	NW.	Brisk.		Clear—flying clouds.
	15	41	60	.00	29.85	W.	do.	.03	Clear—rain.
	16	50	54	29.90	.90	NW.	Moderate.		Cloudy—do.
	17	36	52	30.06	30.00	W.N.	Brisk.		Clear—do.
	18	35	50	.05	.10	W.	do.		Clear—do.
	19	34	50	.10	29.96	W.	Moderate.		Clear—cloudy.
	20	44	51	29.60	.47	SW.	Brisk.	.40	Rain—clear.
	21	44	52	.43	.43	W.	do.		Cloudy—do.
☾	22	41	49	.50	.50	W.	do.		Clear—cloudy.
	23	40	48	.70	.70	W.	Moderate.		Cloudy—do.
	24	39	48	.70	.74	W.	Brisk.		Partially cloudy—do.
	25	32	40	.95	30.05	W.	do.		Clear—flying clouds.
	26	28	49	.85	.00	W.	do.		Clear—do.
	27	38	55	30.06	.06	W.	Moderate.		Hazy—do.
	28	35	50	.30	.35	E.	do.		Hazy—do.
	29	46	59	.33	.30	SW.	do.		Cloudy—partially cloudy.
	30	52	62	.26	.26	W.S.	Calm.		Cloudy—clear.
☉	31	49	63	.27	.30	SW.	do.		Fog—lightly cloudy.
	Mean	42.65	54.77	29.94	29.94			2.85	

	Thermometer.		Barometer.	
Maximum height during the month,	64.00	on the 1st and 11th.	30.35	on the 28th.
Minimum "	28.00	" 30th.	29.43	" 21st.
Mean	48.66		29.94	

METEOROLOGICAL REPORT

FOR THE STATE OF PENNSYLVANIA,

Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for

DECEMBER, 1841.

	County.	Town.	Observer.	Thermometer. 7, A.M.	2, P.M.	9, P.M.	Maximum.	Minimum.	Mean.	Days omitted.	Register. Lowest.	Mean.	Days omitted.	Barometer. 7, A.M.	2, P.M.	9, P.M.	Maximum.	Minimum.	Mean.	Days omitted.	Clear.
1	Philadelphia,	Philadelphia,	E. W. Hamilton,	32.55	46.33	37.87	74.00	15.00	38.92	1/3	10.00	27.47	1	30.05	30.02	30.03	30.75	29.33	30.03	1	21 1/3
2	Montgomery,																				
3	Bucks,	Newtown,	L. H. Parsons,	28.51	37.41	32.51	52.00	10.00	32.81	1/3	7.50	27.27	2	29.91	29.91	29.92	30.60	29.24	29.91	1/3	9
4	Lehigh,																				
5	Northampton,																				
6	Monroe	Stroudsburgh,	A. M. Stokes,	25.33	34.48	22.70	49.00	7.00	27.50	13 1/3	.....	.....	..	29.58	29.64	29.61	30.15	28.95	29.61	12 1/3	7 1/3
7	Pike,																				
8	Wayne,																				
9	Susquehanna,	Silver Lake,	E. Rose,	17.42	24.10	20.10	37.00	-2.00	20.54	.	-2.00	15.55	..	27.77	27.79	27.79	28.21	27.25	27.78	.	3 1/3
10	Luzerne,																				
11	Schuylkill,	Port Carbon	P. Carbon Lyceum,	26.50	39.20	30.30	49.00	3.00	32.00	2 1/3	1.00	22.87	1	29.19	29.21	29.22	29.61	28.66	29.21	2 1/3	9 1/3
12	Berks,																				
13	Chester,	West Chester,	E. W. Bean,	28.90	40.33	33.42	52.00	11.00	34.22	1/3	.....	.....	..	29.44	29.43	29.44	30.07	28.78	29.44	1/3	12
14	Delaware,	Haverford,	Haverford School,	31.55	37.41	34.26	52.00	14.00	34.41	1/3	8.00	26.67	2	29.41	29.37	29.33	30.15	28.75	29.37	4 1/3	10
15	Lancaster,	Lancaster,	Conservatory of Arts,	27.79	39.10	33.74	54.00	10.50	34.21	1/3	10.50	28.13	..	29.45	29.41	29.45	30.07	28.78	29.44	1/3	11
16	York,																				
17	Lebanon,																				
18	Dauphin,	Harrisburg,	J. Heisely,	31.90	35.81	34.84	50.00	16.00	34.18	.	13.00	27.10	..	29.73	29.71	29.72	30.38	29.13	29.72	.	.
19	Northumberland,	Northumberland,	Andrew C. Houston,	28.90	35.58	32.13	48.00	4.00	32.20	.	2.00	25.39	..	29.38	29.40	29.39	30.01	28.70	29.39	.	5 1/3
20	Columbia,																				
21	Bradford,																				
22	Tioga,																				
23	Lycoming,																				
24	Union,																				
25	Mifflin,																				
26	Juniata,	Mifflintown,	J. A. Kinkaid,	28.08	37.42	31.40	50.00	3.00	32.30	2 1/3	.....	.....	..	29.49	29.44	29.45	30.07	28.38	29.46	2	5 1/3
27	Perry,																				
28	Cumberland,	Carlisle	Prof. W. H. Allen,	26.67	36.97	31.13	53.00	7.00	31.59	2/3	7.00	25.77	..	29.33	29.30	29.32	29.93	28.78	29.32	2/3	6 1/3
29	Adams,	Gettysburg,	Prof. M. Jacobs,	26.89	37.44	31.88	52.00	11.00	32.07	1	9.50	25.87	1	29.32	29.31	29.31	29.91	28.73	29.31	1	8 1/3
30	Franklin,																				
31	Huntingdon,	Huntingdon,	Prof. Jacob Miller,	27.32	36.89	32.58	52.00	2.00	32.26	1 1/3	.....	.....	..	29.31	29.29	29.30	29.90	28.70	29.30	1 1/3	8
32	Centre,	Bellefonte,	John Livingston,	30.19	35.73	31.10	47.00	4.00	32.34	1/3	.....	.....	..	29.20	29.18	29.16	29.80	29.52	29.18	1/3	5
33	Potter,																				
34	M'Kean,																				
35	Clearfield,																				
36	Cambria,	Ebensburgh,	Richard Lewis,	24.07	31.04	26.27	51.00	3.00	27.13	2 2/3	3.00	23.03	1	27.70	27.71	27.71	28.14	27.12	27.71	2 2/3	1/3
37	Bedford,	Bedford,	Samuel Brown,	27.86	36.47	31.96	56.00	11.50	32.10	1/3	.....	.....	..	29.13	29.14	29.14	29.70	28.57	29.14	1/3	7
38	Somerset,	Somerset,	George Mowry,	28.44	32.67	29.88	51.00	14.00	30.33	5 2/3	6.50	22.78	3	27.67	27.68	27.71	28.15	27.19	27.69	5 1/3	3 1/3
39	Indiana,																				
40	Jefferson,	Punxsutawny,	J. Smith																		
41	Warren,																				
42	Venango,	Franklin,	Wm. Connely,	34.84	42.13	40.48	56.00	18.00	39.15	.	.....	.....	..	28.95	28.92	28.95	29.80	28.23	28.94	.	.
43	Armstrong,																				
44	Westmoreland,																				
45	Fayette,																				
46	Green,																				
47	Washington,																				
48	Alleghany,	Pittsburgh,	J. P. Bakewell,	38.00	40.85	40.03	49.00	29.00	39.63	1 2/3	12.00	28.94	..	29.09	29.06	29.10	29.65	28.57	29.08	1 2/3	4
49	Beaver,																				
50	Butler,	Butler,	Jacob Mechling,	32.00	37.10	34.90	59.00	12.00	34.67	.	.....	.....	..	28.68	28.71	28.72	29.20	28.10	28.70	.	.
51	Mercer,																				
52	Crawford,	Meadville,	Henry Shippen,	28.57	34.90	29.60	52.00	6.00	31.02	2/3	5.00	25.83	1	28.65	28.68	28.65	29.27	28.03	28.66	2/3	2
53	Erie,																				

	Register.			Barometer.							Weather.										
Days omitted.	Lowest.	Mean.	Days omitted.	7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Clear.	Cloudy.	Days omitted.	Rain.	Snow.	Rain and Snow.	Thunder Showers	Rain in inches.	North.	N. N. E.	N. E.
⅔	10.00	27.47	1	30.05	30.02	30.03	30.75	29.33	30.03	1	21⅔	8⅓	1	10	2	1	..	5.441	4	⅓	3
⅓	7.50	27.27	2	29.91	29.91	29.92	30.60	29.24	29.91	⅓	9	21⅔	⅓	7	2	.....	..	6.625	⅔	1⅓	4
13⅓	.....	.....	..	29.58	29.64	29.61	30.15	28.95	29.61	12⅓	7⅔	11⅓	12	5	3	1	..	5.950	2	.	2
.	-2.00	15.55	..	27.77	27.79	27.79	28.21	27.25	27.78	.	3⅔	27⅓	.	2	7	.....	..	2.433	9⅓	.	.
2⅓	1.00	22.87	1	29.19	29.21	29.22	29.61	28.66	29.21	2⅓	9⅔	18⅓	3	5	5	2	..	4.893	1	.	2
⅓	.....	.....	..	29.44	29.43	29.44	30.07	28.78	29.44	⅓	12	13⅓	5⅔	9	2	1	..	4.840	1⅔	.	1
⅔	8.00	26.67	2	29.41	29.37	29.33	30.15	28.75	29.37	4⅓	10	16⅓	4⅔	6	1	.....	..	6.309	3	1	3
⅓	10.50	28.13	..	29.45	29.41	29.45	30.07	28.78	29.44	⅓	11	19⅔	⅓	4	1	3	..	3.295	3	1⅓	2
.	13.00	27.10	..	29.73	29.71	29.72	30.38	29.13	29.72	.	.	.	.	.....	.....	.....	.....	.....	⅓	.	2
.	2.00	25.39	..	29.38	29.40	29.39	30.01	28.70	29.39	.	5⅓	25⅔	.	7	4	.....	..	5.509	4⅔	.	4
2⅓	.....	.....	..	29.49	29.44	29.45	30.07	28.38	29.46	2	5⅔	22⅓	2⅓	.....	.....	.....	..	.....	⅓	.	1
⅔	7.00	25.77	..	29.33	29.30	29.32	29.93	28.78	29.32	⅔	6⅓	23⅔	⅔	4	1	2	..	5.690	2⅔	.	4
1	9.50	25.87	1	29.32	29.31	29.31	29.91	28.73	29.31	1	8⅓	21⅔	1	9	2	.....	..	6.060	3	1⅓	2
1⅓	.....	.....	..	29.31	29.29	29.30	29.90	28.70	29.30	1⅓	8	23	.	8	2	2	..	3.593	.	.	.
⅓	.....	.....	..	29.20	29.18	29.16	29.80	29.52	29.18	⅓	5	25⅔	⅓	7	3	1	..	4.410	5⅓	.	2
2⅔	3.00	23.03	1	27.70	27.71	27.71	28.14	27.12	27.71	2⅔	⅓	26⅓	4⅓	4	4	1	..	2.128	2	.	.
⅓	.....	.....	..	29.13	29.14	29.14	29.70	28.57	29.14	⅓	7	23⅔	⅓	.....	.....	.....	.....	.....	.	.	.
5⅔	6.50	22.78	3	27.67	27.68	27.71	28.15	27.19	27.69	5⅓	3⅓	22	5⅔	4	1	7	..	3.664	.	.	.
.	.....	.....	..	28.95	28.92	28.95	29.80	28.23	28.94	.	.	.	.	7	4	.....	..	3.798	.	.	.
12⅓	12.00	28.94	..	29.09	29.06	29.10	29.65	28.57	29.08	12⅓	4	25⅓	12⅓	9	2	2	..	3.744	.	.	3
.	.....	.....	..	28.68	28.71	28.72	29.20	28.10	28.70	.	.	.	.	5	7	1	..	3.985	.	.	1
⅔	5.00	25.83	1	28.65	28.68	28.65	29.27	28.03	28.66	⅔	2	27⅓	1⅔	6	4	3	..	4.125	3	.	.

	Winds.																		Hygrometer.					
	North.	N.N.E.	N.E.	E.N.E.	East.	E.S.E.	S.E.	S.S.E.	South.	S.S.W.	S.W.	W.S.W.	West.	W.N.W.	N.W.	N.N.W.	Calm.	Days omitted.	Dew-point.	Days omitted.	Diff. therm. and dew-point	Wet Bulb.	Days omitted.	No. of Report.
1	4		3	.	1	.	1	.	1		4		5	1	5		.	1	....	.	.....	....	.	1793
5		1	4	.		.	1	.	.	.	6		2	2	8		.	2	....	.	.....	....	.	1719
0	2	.	2	.	4	.	1	.	.	.		.	6	.	3	.	.	12	....	.	.....	....	.	1694
3	9	.	.	.	.	.	2	.	.	.	1	.	8	.	9	.	.	.	....	.	.....	....	.	1733
3	1	.	2	.	1	.		.	.	.	1	.	3	.	6	.	12	2	....	.	.....	....	.	1668
0	1	.	1	.	1	.	.	.	6	.		.	14	.		.	5		....	.	.....	....	.	1682
9	3	1	3		1	.	.	.	.		1	1	6	2	5	1	2		....	.	.....	....	.	1681
5	3	1	2		1		1	1	2	2	2	1	5	2	1	2	.		31.21	1	.....	36.47	1	1742
..		.	2	.	2	.	6	.	.	.	.	.	3	.	15	.	.	.	....	.	.....	....	.	1660
9	4	.	4	.	3	.		.	2	.	1	.	7	.	3	.	3	.	....	.	.....	....	.	1659
.		.	1	.		.		.	.	.		.	3	.	8	.	14	1	....	.	.....	....	.	1691
0	2	.	4	.		.			4		3		2	1	5	.	8		....	.	.....	....	.	1662
0	3	1	2	.	.	.		1	4		2		4		3		4	1	31.57	20	.....	39.13	20	1747
3	.	.	.	.	6	.	.	.	.	.	.	.	23	.	.	.	.	1	....	.	.....	....	.	1685
0	5	.	2	.	.	.	2	.	1	.	4	.	3	.	11	.	.		....	.	.....	....	.	1664
8	2	.		.	.	.	4	.	1	.	3	.	12	.	3	.		2	....	.	.....	....	.	1684
..	.	.	.	.		.	5	.	.	1	7	.	3	.	8	4	.		....	.	.....	....	.	1661
4	.	.	.	.		.	2	.	1	.	2	2	7		2	.	7	5	....	.	.. .	29.96	7	1701
8	.	.	.	.	.	.	5	.	.	.	8	.	.	.	17	.	.	.	....	.	.....	....	.	1683
4	.	.	3	1			3	.	.	.		.	1	2	6	.	9	1	....	.	....	....	.	1665
5	.	.	1	.	7	.	1	.		.	11	.	6	.	3	.	.	.	....	.	.....	....	.	1663
5	3	.	.	.	1	.	1	.	6	.	4	.	5	.	2	.	6	2	....	.	.....	....	.	1666

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